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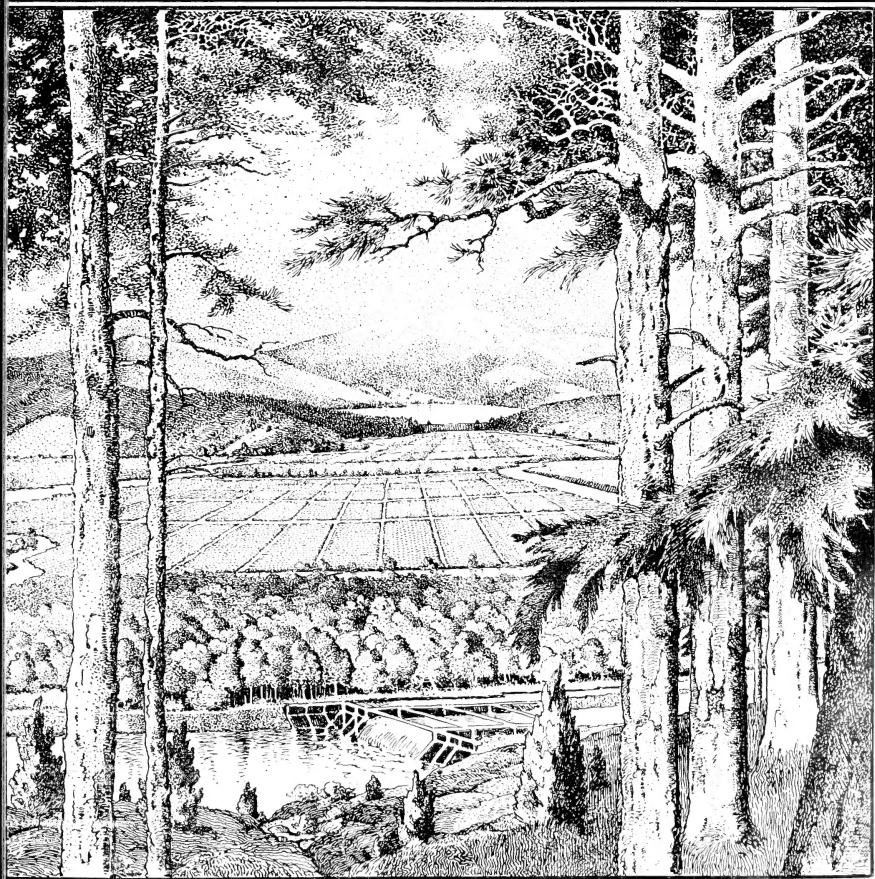
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AMERICAN FORESTS CONGRESS

76. XI—No. 1—12

JANUARY, 1905

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FORESTRY & IRRIGATION



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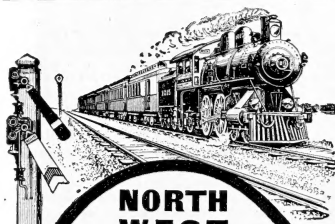
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OF THE

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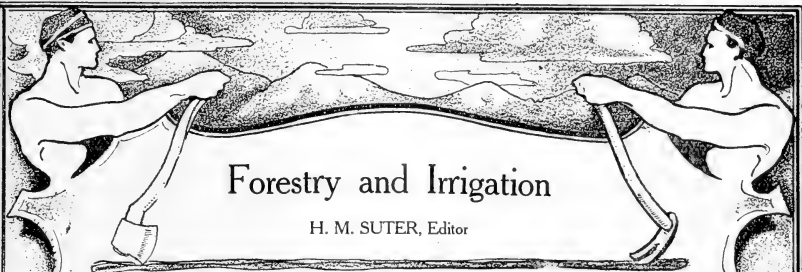
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Secretary American Forestry Association,

510 Twelfth St., N. W., Washington, D. C.



Forestry and Irrigation

H. M. SUTER, Editor

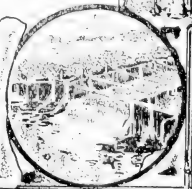
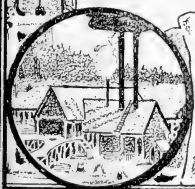
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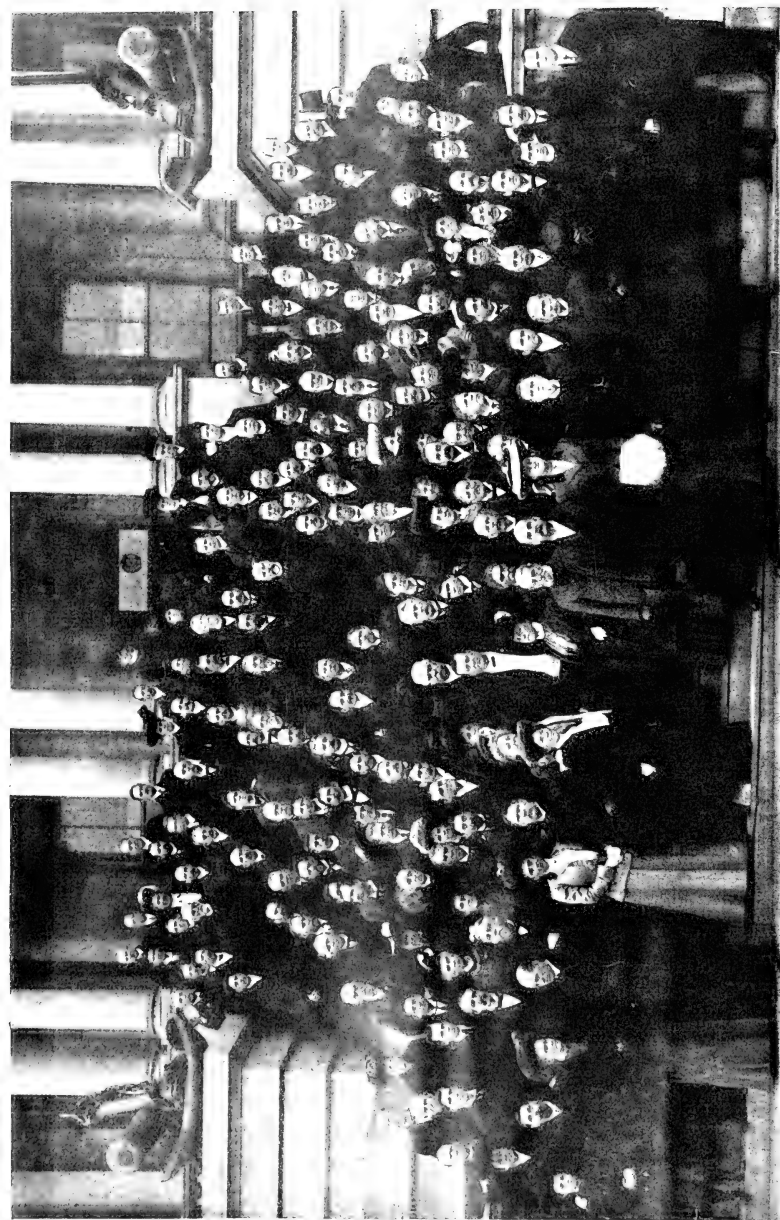


Photo by Friese, Washington, D. C.

A Group of Delegates to the American Forest Congress as they Appeared on the Steps of the Navy Department Just Before their Reception by the President at the White House. This Group Includes Only those Delegates who had Arrived by Noon on January Second.

Forestry and Irrigation.

VOL. XI.

JANUARY, 1905.

NO. 1.

AMERICAN FOREST CONGRESS

Held at Washington, D. C., January 2 to 6—A
Large Attendance of Delegates Representing Im-
portant Interests in Every Section of the Country

THE American Forest Congress, held at Washington, D. C., the first week in January, was not only by far the most successful meeting devoted to forestry that has been held in this country, but it will go down as one of the most striking gatherings that has been given up to any economic subject. Washington is a city that sees many important conventions every year, and the American Forest Congress in the opinion of men prominent in official life was among the most influential gatherings that have taken place at the nation's capital in a score of years.

The purpose of this Congress, as announced in the official call, was "to establish a broader understanding of the forest in its relation to the great industries depending upon it; to advance the conservative use of forest resources for both the present and the future needs of these industries, and to stimulate and unite all efforts to perpetuate the forest as a permanent resource of the nation."

That the time was ripe for such a gathering is amply testified to by the large and influential crowd of delegates who attended. The attendance, which far exceeded the expectations of the Committee on Arrangements, included practically all persons engaged directly in forest work, the leaders in state forest associations, and an unusually influential lot of representatives from the railroad, lumbering, mining, irrigation, and grazing interests of the country. A better idea of the attendance at, and interest in the Congress can be had when it is stated that at its eight separate sessions the average attendance was 1,000. The large hall was crowded at the opening

session, and the interest was so keen throughout the Congress that the attendance at the last session was even larger.

In addition to a special meeting at which a notable address by the President of the United States was the leading feature, the program included half-day sessions devoted particularly to irrigation, the lumbering industry, the grazing industry, railroads in their relation to the forest, importance of forests to mining, and one devoted to national and state forest policy. At each of these sessions a man prominent in the line of work under discussion acted as presiding officer, while the papers and addresses presented were by men of achievement in their particular lines of work.

To President Roosevelt, whose emphatic stand on forest questions has done so much for the movement, and whose address at this Congress is a further ringing "call to arms," such a gathering must have been very reassuring. Likewise to Secretary Wilson, who has for nearly eight years been such a staunch friend of the Government's forest work, and in addition, as President of the American Forestry Association, has given decided impetus to the general forest movement, the success of this Congress must be especially pleasing.

More than all, to Mr. Gifford Pinchot, Forester of the United States Department of Agriculture, who has worked with untiring energy to bring about a better understanding in regard to our forests, the meaning of such a gathering, and the many deserved tributes paid to his work during it, must come with special gratification and significance and give him immense

encouragement for the future of the great work in his charge. It is not too much to say that forestry takes on a new meaning to the American people from the date of this Congress.

As the daily proceedings of the Congress have appeared in the newspapers and the full text of its proceedings will be published in book form about March 1, this account is limited to a mere outline of what occurred at the various sessions. The resolutions adopted by the Congress and the list of delegates attending are given in full.

Beginning on Monday, January 2nd, the day set aside on the program for the registration of delegates and attendance at President Roosevelt's New Year's reception at the White House, the success of the Congress was assured. As early as eight o'clock in the morning, before the doors of the National Rifles' Armory were open many delegates were seeking admission in order to register and receive their delegates' cards. During the day about two hundred and fifty delegates, coming from every section of the United States, and some from Canada, had called upon Mr. William L. Hall, Secretary of the Congress, and presented their credentials.

At noon, according to program, the delegates began to assemble at the northeast entrance to the War, State, and Navy building, in order to attend President Roosevelt's reception in a body. It was here that the photograph was taken from which the frontispiece of this number of *FORESTRY AND IRRIGATION* was made. It shows only those delegates who had arrived up to noon on Monday, January 2. Promptly at 12:45 the delegation, headed by Mr. Gifford Pinchot, took up the position in line reserved for it.

Following the White House reception there were no further events scheduled for the delegates, the committee on arrangements having felt that the balance of Monday should be open in order that all could get settled in time for the regular sessions of the Congress beginning Tuesday morning.

THE OPENING SESSION.

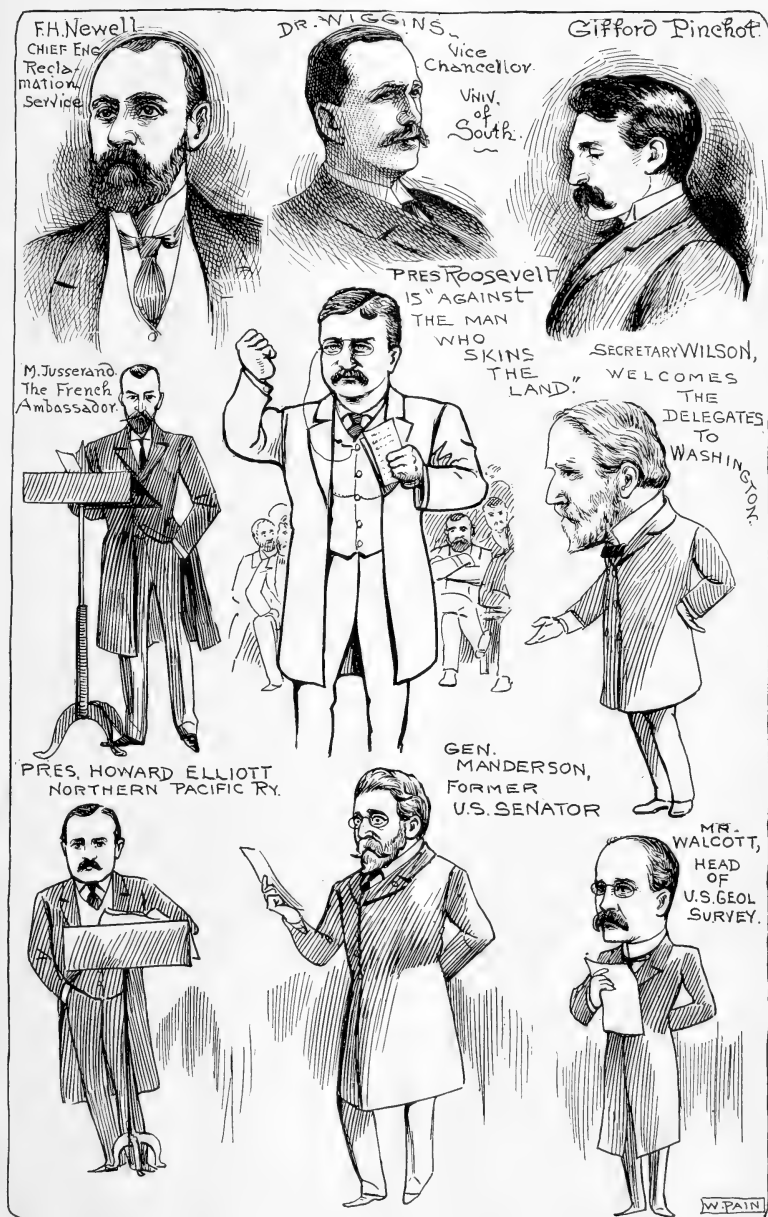
At 10 o'clock, Tuesday morning,

promptly on the hour, President Wilson called the Congress to order. In spite of unusually disagreeable weather, the large assembly hall was crowded to the doors, more than one thousand persons being present. As President of the Congress and of the American Forestry Association, under whose auspices it was being held, Hon. James Wilson delivered the address of welcome. President Wilson's address was followed by the reading of the report of the Directors of the American Forestry Association on the "Progress and Condition of Forestry in the United States." The report was presented by Mr. Edward A. Bowers.

Immediately following, the chair appointed a committee on resolutions, consisting of Mr. F. J. Hagenbarth, president of the National Live Stock Association; Mr. N. W. McLeod, president, National Lumber Manufacturers' Association; Mr. Gifford Pinchot, Forester, United States Department of Agriculture; Mr. T. J. Grier, superintendent, Homestake Mining Company, of South Dakota; Mr. Thomas Cooper, land commissioner, Northern Pacific Railway; Dr. J. T. Rothrock, of the Pennsylvania Reservation Commission, and Mr. F. H. Newell, chief engineer, United States Reclamation Service.

At this point, President Wilson called on Hon. John Lacey, Member of Congress from Iowa, and chairman of the House Committee on Public Lands, for a short address. Mr. Lacey responded in excellent spirit, stating his high appreciation of the needs of conservative forest management in the United States; and he paid a glowing tribute to the Secretary of Agriculture and to Mr. Pinchot for their excellent work in directing the Government forest service. He was followed by Mr. Aubrey White, commissioner of Crown lands of Canada, who described in an interesting manner the forest resources of Canada, and how his government is looking out for their preservation.

Following Mr. White, Mr. W. S. Harvey, president of the board of trustees of the Philadelphia Commercial Museum, and representative of the



Pennsylvania State Forestry Association, was called upon and made an interesting talk on the commercial value of forestry, and made numerous suggestions regarding general forest policy. General Charles F. Manderson, former United States Senator from Nebraska, and a representative of the Chicago, Burlington & Quincy Railroad, was the next speaker, and he made an eloquent appeal for the general preservation of the forests. Dr. J. T. Rothrock, ex-commissioner of forestry of Pennsylvania, and at present secretary of its forest reservation committee, was the next to be called upon. He asked that as a mark of respect to the various delegates who had come from every section of the country to attend the Congress, that those who were not members of the American Forestry Association be elected by the directors at the earliest possible hour, as a mark of appreciation—a suggestion which was acted upon favorably at a later session of the Congress.

Hon. W. A. Reeder, Member of Congress from Kansas, followed with a short address, and called special attention to the dependence of the irrigation interests on prosperous forests. He also alluded to the glaring land frauds in the West, and suggested that the American Forest Congress use its efforts to petition the Congress of the United States to repeal the present vicious laws. The Rev. Dr. Edward Everett Hale was then asked to speak, and responded in characteristic fashion, putting forth a special plea for the preservation of the White Mountain forests in New Hampshire. Professor Roth followed with an interesting talk on forest conditions in Michigan; he in turn was followed by Dr. C. A. Schenk, director of the Biltmore Forest School, who spoke interestingly of forest conditions in the Southern Appalachians. The morning session closed with a short address by Mr. E. S. Gosney, president of the Arizona Wool Growers' Association.

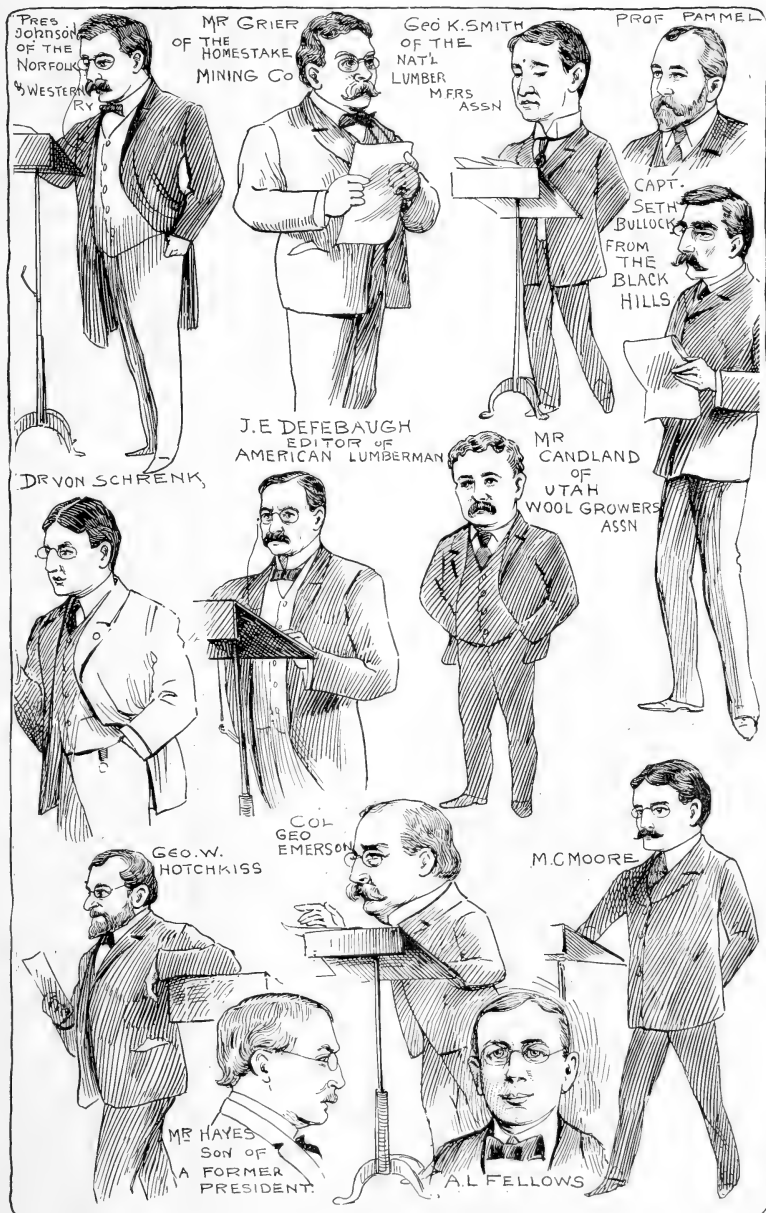
SESSION OF TUESDAY AFTERNOON, JANUARY 3.

This session was devoted particular-

ly to the importance of the public forest lands to irrigation. Mr. F. H. Newell, chief engineer of the United States Reclamation Service, was in the chair. The first paper of this session was on "The Close Relation Between Forestry and Irrigation," by Mr. Guy Elliot Mitchell, secretary of the National Irrigation Association, who described in a pointed way the close dependence of the success of irrigation on the forest. At this point Mr. Newell asked United States Senator Clark, of Wyoming, to take the chair. Mr. Newell then spoke on the subject of "Forests and Reservoirs," outlining in a succinct manner the immense part that is being played by the forests in the reclamation work of which he is the head.

Following Mr. Newell, Mr. J. B. Lippincott, supervising engineer of the Reclamation Service, delivered an exceedingly valuable address on "The Relation of Forests to Stream Flow." Mr. Lippincott was followed by Mr. Morris Bien, in charge of the legal work of the Reclamation Service, who took for his topic the pertinent subject, "Rights of Way in the Forest Reserves." "Irrigation Construction and Timber Supplies" was the subject offered by Mr. Arthur P. Davis, assistant chief engineer of the United States Reclamation Service. Two short impromptu addresses by Mr. H. M. Wilson, of the United States Geological Survey, and Professor Toumey, of the Yale Forest School, followed.

Mr. Hayes, president of the Appalachian Park Association, was then introduced and made an appeal for the establishment of a forest reserve in the mountains of the south. He was followed by Mrs. Lydia Phillips Williams, one of the delegates from Minnesota, and chairman of the forestry committee of the International Federation of Women's Clubs. She made an excellent address, showing what a potent force the women's organizations have been in the forest movement. Dr. B. E. Fernow was then called on and responded with a short and valuable address.



THE LUMBERING INDUSTRY AND THE FORESTS.

This session, which was called to order at 10 a. m. on Tuesday, January 4, was devoted entirely to the foregoing subject. Mr. N. W. McLeod, president of the National Lumber Manufacturers' Association, was in the chair. After an exceedingly interesting talk from Mr. McLeod, he introduced Mr. J. E. Defebaugh, Editor of the *American Lumberman*, who addressed the Congress on the subject of the "Changed Attitude of Lumbermen on Forestry."

He was followed by Mr. M. C. Moore, secretary of the National Slack Cooperage Manufacturers' Association, on "The Importance of Forestry to the Woodworking Industry." A paper was then presented by Mr. John L. Kaul, president of the Kaul Lumber Company of Alabama, on the question "Is Forestry Practicable on Long-leaf Pine Lands?" Colonel George P. Emerson, vice-president of the Northwestern Lumber Company of Washington, addressed the Congress on "Our Pacific Coast Forests, and Lumbering as Differing From Other Forests." Mr. George K. Smith, secretary of the National Lumbermen Manufacturers' Association, then spoke on "The Importance of Lumbering Statistics." "Opportunities for Lumbering in the Philippines" was the subject of a talk by Captain George P. Ahern, chief of the Philippine Forestry Bureau. Owing to illness, Dr. Albert Shaw, Editor of the *Review of Reviews*, was unable to be present to deliver his address on "The Relation of the Forests to the Publishing Business."

The next speaker was Mr. George W. Hotchkiss, secretary of the Illinois Lumber Dealers' Association, who spoke on "The Lumber Dealers' Interest in Forest Preservation." He was followed by Mr. John A. McCann, editor *National Coopers' Journal*, on "Cooperage and Its Relation to Forestry."

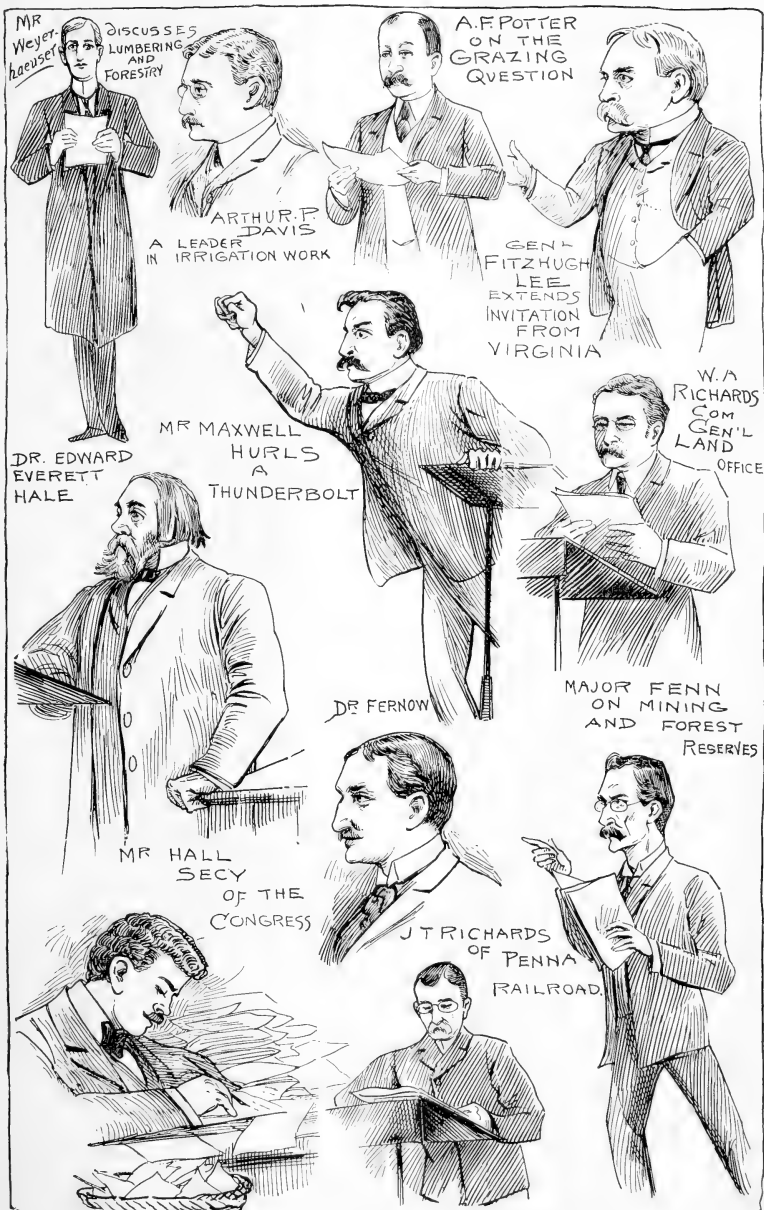
THE GRAZING SESSION.

Mr. F. J. Hagenbarth, president of the National Live Stock Association,

presided over the meeting on the afternoon of January 4, which was called to order at 2 p. m. The first speaker was Mr. W. B. Candland, of the Utah Wool Growers' Association. Mr. A. F. Potter, grazing expert, of the Bureau of Forestry, then delivered an address on the subject of "Practical Results of the Regulation of Grazing on the Forest Reserves," illustrated by examples, and with the subject clearly expounded. "The Protection of Home Builders in the Regulation of Grazing on the Forest Reserves" was the topic discussed by Mr. E. S. Gosney, president of the Arizona Wool Growers' Association. An interesting address was contributed on the subject of "Sheep Grazing in the Reserves, From a Layman's Standpoint," by Prof. L. H. Pammel, of the Iowa State College. General Fitzhugh Lee was introduced, and extended an invitation to the members of the Congress to visit the Jamsetown Exposition in 1907. The open discussion which followed was participated in by Mr. Jackson; Mr. Campbell, secretary of the Canadian Forestry Association; Mr. G. O. Shields, of New York, president of the League of American Sportsmen; Mr. Lynn, of Idaho, and Mr. Little, of Oklahoma.

RECEPTION BY MR. PINCHOT.

On Wednesday evening, January 4, the more serious part of the program was laid aside, and the delegates and their friends attended a delightful reception given in their honor by Mr. and Mrs. James W. Pinchot and their son, Mr. Gifford Pinchot, forester of the United States Department of Agriculture. Mrs. Pinchot, who welcomed the guests, was assisted in receiving by the Secretary of Agriculture and Mr. Gifford Pinchot. The other members of the receiving party were Mrs. Taft, wife of the Secretary of War; Mrs. Hitchcock, wife of the Secretary of the Interior; Mrs. Chaffee, wife of the Lieutenant-General of the United States Army; Mrs. Walcott, wife of the director of the United States Geological Survey; Mrs. Newell, wife of the chief engineer of the Reclamation Service; Mrs. Hobson, Mrs. J. B.



Henderson, Mrs. Archibald Hopkins, Mrs. Cowles, Mrs. W. P. Eno, Mrs. Spencer, Miss Bigelow, Miss Boardman, and Miss Morgan. The assemblage was a varied one, including prominent western mining men, leading stockmen, scientists, lumbermen, foresters, public men, diplomats, officers of the Army and Navy, and still others who were just plain citizens. In the decorations the green of the forest was prominent in the halls and spacious library, where refreshments were served; every decoration was in keeping, including candy in the shape of logs and log shavings; miniature trees with candy icicles, and many other pleasing and dainty reminders of the forest. It was a remarkable gathering of interesting people, even for Washington.

RAILROADS AND THE FORESTS.

With Mr. Howard Elliott, president of the Northern Pacific Railroad, in the chair, the session of Thursday morning was called to order at 10 o'clock for the discussion of the above topic. General Charles Manderson, general solicitor of the Chicago, Burlington & Quincy Railroad, was introduced as the first speaker by Mr. Elliott, his topic being "What Information is Most Urgently Needed by Railroads Regarding Timber Resources." In line with the Bureau of Forestry's widely exploited experiments in treating railroad ties, the next paper, on "The Work of the Pennsylvania Railroad in Planting Timber for Cross-ties," by Mr. J. T. Richards, chief engineer, maintenance of way, Pennsylvania Railroad system, was particularly timely. A number of interesting facts were brought out in President L. E. Johnson's address on the question "Is It Practicable for Railroads to Hold Forest Lands for Future Supplies of Timber?" Mr. Johnson is the president of the Norfolk & Western Railroad Company. Considerable interest was displayed in Mr. Hermann von Schrenk's paper on "The Results of the Preservative Treatment of Railroad Timbers to Prolong Durability," as he is in charge of the timber-testing plants of the Bureau of Forestry.

During this session Dr. Edward Everett Hale presented a resolution favoring the establishment of a national forest reserve in the White Mountains. Mr. Harvey made an announcement that all delegates not already members of the American Forestry Association had been elected at a special meeting of the board of directors, as suggested by Dr. J. T. Rothrock at the opening session on Tuesday.

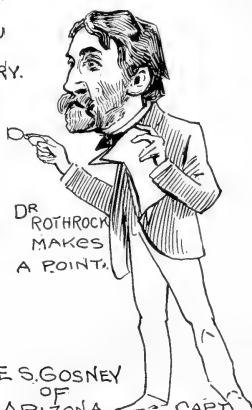
SPECIAL SESSION, THURSDAY AFTER-NOON, JANUARY 5.

The interest of the Congress was centered in this session, held at the National Theater, which attracted an audience of more than 2,000 persons, at which President Roosevelt delivered the principal address, on "The Forest in the Life of a Nation." The President's address made a deep impression and will be a tremendous influence in the forest movement, as it has been published throughout the country. Secretary Wilson was chairman of the meeting. "The Forest Policy of France" was discussed in an exceedingly interesting manner by Mr. J. J. Jusserand, Ambassador to the United States from France, and Mr. Howard Elliott, president of the Northern Pacific Railway, presented an able discussion of "The Dependence of the Business Interests Upon the Forests." He was followed by Mr. F. E. Weyerhaeuser, of the Weyerhaeuser Lumber Company.

Dr. B. L. Wiggins, vice-chancellor of the University of the South, read an able paper on the "Attitude of Educational Institutions Toward Forestry." In it he sketched the beginning of education in forestry in this country and the trend it is likely to take in the future. The closing address of the meeting was delivered by Hon. John Lamb, Member of Congress from Virginia, who spoke eloquently of the "Importance of Forests to Agriculture."

FORESTRY AND MINING.

Dr. David T. Day, of the United States Geological Survey, presided at the morning session on Friday, January 6, when discussions were confined

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MORRIS BIEN
OF THE
RECLAMATION
SERVICE

to the subject mentioned above. Mr. A. L. Fellows, consulting engineer, United States Reclamation Service, delivered the opening address, on the subject of "The Development of Water Power as Related to Forest Reserves." Dr. Day then made a short address. Captain Seth Bullock, supervisor of the Black Hills Forest Reserve, presented a valuable paper on the question "Will the Administration of the Forest Reserves on a Conservative Basis Retard the Development of Mining?" Mr. T. J. Grier, superintendent of the Homestake Mining Company of South Dakota, addressed the Congress on "How the Forest Reserves Help Mining." Following this, Maj. F. A. Fenn, supervisor forest reserves in Idaho and Montana, spoke on "Mining in the Forest Reserves." The closing address of this session was delivered by Mr. George H. Maxwell, executive chairman of the National Irrigation Association, on the "Value of Forestry to Commercial Interests." He aroused much enthusiasm and showed clearly how generally the business interests are dependent on the forests of the country.

FINAL SESSION, JANUARY 6.

Owing to the great amount of business to be accomplished by the Congress, the afternoon's regular program was shortened considerably, two ad-

resses being omitted, and the extra time given over to discussion of resolutions, adoption of same, and miscellaneous business. Mr. Gifford Pinchot presided at the meeting, and Secretary Wilson was present to make a farewell speech to the delegates. Mr. Charles D. Walcott, director of the United States Geological Survey, presented the "Work of the Geological Survey in Mapping the Reserves" in a graphic manner; and Mr. W. A. Richards, commissioner of the General Land Office, outlined the work of his department in the administration of the reserves. Mr. Overton W. Price, associate forester, Bureau of Forestry, was then called upon by Mr. Pinchot to describe the work and aims of the Bureau of Forestry, after which the entire time of the Congress was given over to the considerations of the report of the Committee on Resolutions, and the discussion of miscellaneous subjects of general interest.

In addition to the various events on the regular program, two informal "smokers" were held at the Shoreham Hotel, one on Tuesday evening, January 3, and the other on Thursday evening, January 5. They were attended mainly by men actively engaged in forest work and the discussions were of a technical character.

RESOLUTIONS

Following is the Text of the Resolutions Adopted by the Congress:

RESOLVED, That we urge upon Congress and upon all legislative bodies the necessity at all times of giving full protection to the forests of the country and of preserving them through wise and beneficent laws, so that they may contribute in the most complete manner to the continued prosperity of the country.

RESOLVED, That we earnestly commend to all state authorities the enactment and enforcement of laws for the protection of the forests from

fire, and for reducing the burden of taxation on lands held for forest reproduction in order that persons and corporations may be induced to put in practice the principles of forest conservation.

RESOLVED, That we are in entire accord with the efforts to repeal the Timber and Stone Act, and we favor the passage of an act as a substitute therefor which shall confer authority upon the proper officer of the United States to sell timber growing on the

public lands when such sale shall be for the public welfare.

RESOLVED, That we favor the passage by Congress of an amendment to the law regarding exchange of lands included within a forest reserve so that such exchanges or lieu selections shall be confined to lands of equivalent value or similar condition as regards forest growth.

RESOLVED, That the law which prohibits the export of forest reserve timber from the state in which it is grown should be repealed as to the states in which the export of such timber is in the public interest, and in no others.

RESOLVED, That we favor the passage of a law which will authorize the sale of all the non-mineral products of the forest reserves, the proceeds of such sales to be applied to their management and protection, and the construction of roads and trails within the forest reserves.

RESOLVED, That we heartily approve the movement for the unification of all the forest work of the Government, including the administration of the National Forest Reserves, in the Department of Agriculture, and urge upon Congress the necessity for immediate action to that end.

RESOLVED, That Congress declare forfeited all right of way permits not exercised promptly upon issuance, and secure to all industries engaged in lawful business, and which will exercise promptly their permits, the possession of necessary rights of way, in the same manner that railroads and irrigating companies are secured in their rights of way, and that the various right-of-way acts on forest reserves and other public lands be so amended as to provide for reasonable payment for the use of these valuable rights.

RESOLVED, That this Congress urges upon all schools, and especially the rural schools, the necessity for a study of forests and tree-planting in their effect upon the general well-being of the nation, and in particular upon the wealth and happiness of communities through the modification of local climate; and that we urge all

state legislatures to provide laws and financial aid to consolidate the rural schools in units sufficiently large that forestry, agriculture, and home economics may be successfully taught by precept, example, and practical work.

RESOLVED, That this Congress recommends the increase of opportunities for general forest education in schools and colleges, and for professional training in post-graduate schools; and approves the movement to extend and systematize industrial education in the interest of a more general distribution of the population on the land.

RESOLVED, That the Congress of the United States be asked to appropriate adequate sums for the promotion of forest education and forest experiment work in the agricultural colleges and experiment stations of the United States; Provided, however, such appropriations be made directly to state forestry departments, bureaus, or commissions, where existing, to be used in their respective states as may seem best for forestry educational purposes.

RESOLVED, That this Congress approves and reaffirms the resolutions of various scientific and commercial bodies during the past few years in favor of the establishment of national forest reserves in the Southern Appalachian Mountains and in the White Mountains of New Hampshire, and that we earnestly urge the immediate passage of bills for these purposes which are now pending in both houses of Congress.

RESOLVED, That we protest against the attempt to reduce the area of the Minnesota National Forest Reserve and against any step which would enhance the difficulty of the perpetuation of the forests upon it.

RESOLVED, That we heartily endorse the movement for the purchase of the Calaveras Grove of Big Trees by the National Government and earnestly recommend the prompt enactment of legislation to that end; and, further, we recommend the reconveying by the State of California to the National Government of the Yosemite

Park in order that this may be adequately protected and placed upon the same basis as other national parks.

RESOLVED, That this Congress urges tree-planting and the preservation of shade trees along public highways throughout America.

RESOLVED, That we approve the suggestion that a tree be planted at Mount Vernon to commemorate the American Forest Congress, and that funds for this purpose be collected through *Forestry and Irrigation*.

RESOLVED, That as Oklahoma would immeasurably profit by increased land valuation resulting from greater crop capacity as the outgrowth of wind reduction; therefore, the territory should be empowered to offer

school land occupants a reasonable realty tax reduction during a stipulated growing period of tree wind-breaks; Provided, that the department of government under which the nation's forestry interests are managed shall outline, control, and perfect, in all particulars, determining how and to which lands the provisions shall apply, except that purchasers at the time of sale have option as to acceptance of these terms.

RESOLVED, That it is the sense of this Congress that the National Homestead Law should be amended so as to require the planting of at least 5 per cent of the area of a homestead before final title be acquired, and that the tree planting be under the supervision of the Bureau of Forestry.

LIST OF DELEGATES

Following is a complete list of Delegates to the American Forest Congress who registered at the Secretary's office:

Adams, J. B., Washington, D. C.; representing Bureau of Forestry.
 Adams, Miss B. E., Washington, D. C.; Gen. Land Office.
 Agar, John G., New York city; Society for Protection of the Adirondacks.
 Agnew, Mrs. Kate L., Valparaiso, Ind.; State of Indiana.
 Ahern, Capt. Geo. P., Manila; Forestry Bureau of Philippines.
 Aitken, Geo., Woodstock, Vt.; Vermont Forestry Association.
 Akerman, A. K., State Forester, Boston, Mass.; Massachusetts Forestry Association.
 Allen, E. T., Forest Inspector, Bureau of Forestry, Washington, D. C.
 Allen, E. W., Office of Ex. Stations, Dept. of Agric., Washington, D. C.
 Anderson, A. A., New York city; Forest Reserve Service and New York Chamber of Commerce.
 Anderson, J. W., Gen. Land Office, Washington, D. C.
 Andrews, Byron, Washington, D. C.; American Forestry Association from South Dakota.

Atkinson, A. L. C., Honolulu, Hawaii.
 Ayres, Philip W., Forester, Society for Protection of New Hampshire Forests, Concord, N. H.

■

Baily, Joshua L., Philadelphia, Pa.; American Forestry Association from Pennsylvania.
 Baird, Dan. W., Nashville, Tenn.; Editor *Southern Lumberman*.
 Baker, J. F., Bureau of Forestry, Washington, D. C.; Salim Valley Telephone Co.
 Ball, C. R., Washington, D. C.; Iowa Park and Forestry Association.
 Barber, J. T., Eau Claire, Wis.; Miss. Val. Lumberman's Assn. and Northwestern Hemlock Mfrs. Assn.
 Barnard, E. C., U. S. Geological Survey, Washington, D. C.
 Barns, W. E., St. Louis, Mo.; Editor *St. Louis Lumberman*.
 Bartlett, J. H., Middleboro, Ky.; State of Kentucky.
 Becker, G. F., U. S. Geological Survey, Washington, D. C.
 Beecher, F. R., Retail Lumber Dealers' Assn., Canadaigua, N. Y.
 Bell, Dr. Robt., Agricultural Department, Ottawa, Ontario, Canada; Canadian Forestry Association.

B

- Bentz, Hon. P. J., Woonsocket, S. D.; State of South Dakota.
- Berg, Walter G., Philadelphia, Pa.; Lehigh Valley R. R. system.
- Berthrong, I. P., Washington, D. C.; General Land Office.
- Bidwell, Geo. F., Chicago, Ill.; Chicago & Northwestern Ry. Co.
- Bien, Morris, U. S. Geological Survey, Washington, D. C.
- Binford, L. M., Saco, Maine; National Assn. of Box and Box Shook Mfrs. of United States.
- Bitler, F. L., Philadelphia, Pa.; Pennsylvania Forestry Association.
- Blades, J. B., Elizabeth City, N. C.; National Wholesale Lumber Dealers' Association and North Carolina Forestry Association.
- Blanchard, C. J., U. S. Geological Survey, Washington, D. C.
- Bliss, Geo. H., Spokane, Wash.; Reclamation Service.
- Blodgett, James H., Washington, D. C.; American Forestry Association.
- Bogue, Prof. E. E., Michigan Agricultural College, Agricultural College P. O., Michigan.
- Bond, Frank, General Land Office, Washington, D. C.
- Borst, Theo. F., Clinton, Mass.; American Forestry Association from Massachusetts.
- Brooks, Hon. F. E., Colorado Springs, Colo.; State of Colorado.
- Bowers, Edward A., New Haven, Conn.; Connecticut Forestry Association and American Forestry Assn.
- Brooks, A. H., U. S. Geological Survey, Washington, D. C.
- Bruce, E. S., Bureau of Forestry, Washington, D. C.
- Bruce, Grant, Bureau of Forestry, Washington, D. C.; American Forestry Association.
- Bullock, Capt. Seth, Deadwood, S. D.; South Dakota Forest Reserve Service.
- Bunker, Wm. M., Washington, D. C.; Chamber of Commerce of San Francisco.
- Burkholder, S., Crawfordsville, Ind.; National Wholesale Lumber Dealers' Association.
- Burton, P. G., Chesapeake & Potomac Telephone Co., Washington, D. C.

C

- Campbell, R. H., Secretary Canadian Forestry Association, Ottawa, Ontario, Canada.
- Candland, W. D., Mt. Pleasant, Utah; Utah Wool Growers' Association.
- Cary, Austin, Brunswick, Me.; American Forestry Assn. from Maine.
- Chapman, C. S., Bureau of Forestry, Washington, D. C.
- Chapman, Herman H., Bureau of Forestry, Washington, D. C.; American Forestry Association.
- Charlton, R. H., Denver, Colo.; Forest Reserve Service.
- Chittenden, A. K., Bureau of Forestry, Washington, D. C.
- Chown, C. Y., Queen's University, Kingston, Ontario, Canada.
- Churchill, C. S., Roanoke, Va.; Norfolk & Western Railway.
- Clark, C. C., Washington, D. C.; Department of Agriculture.
- Clark, Hon. Clarence D., U. S. Senate, Washington, D. C.; State of Wyoming.
- Clark, Dr. J. F., Department of the Interior, Ontario, Canada; Ontario Bureau of Forestry.
- Clark, Dr. Wm. B., State Geologist, Baltimore, Md.; State Geological and Economic Society.
- Clarke, S. A., Gen. Land Office, Washington, D. C.; State of Oregon.
- Clement, G. E., Bureau of Forestry, Washington, D. C.; American Forestry Association.
- Cleveland, J. F., Chicago, Ill.; Chicago & Northwestern Railway.
- Clothier, Geo. L., Bureau of Forestry, Washington, D. C.
- Cochran, Geo. G., New York city; Erie Railroad Co.
- Cone, Albert B., Chicago, Ill.; *American Lumberman*.
- Conklin, Robt. S., Harrisburg, Pa.; Pennsylvania Forestry Association and Forestry Commission.
- Cooke, Chas. B., Richmond, Va.; State of Virginia.
- Cooper, Thos., St. Paul, Minn.; Northern Pacific Railway Co.
- Cosgriffe, T. A., Cheyenne, Wyo.; Northern Pacific Railroad.
- Coville, F. V., Washington, D. C.; American Forestry Association.

C

- Cox, Wm. T., St. Anthony Park, Minn.; Minnesota State Forestry Association.
- Craft, Q. R., Washington, D. C.; American Forestry Association from Kansas.
- Craig, A. R., Mesa, Cal.; Forest Reserve Service.
- Crawford, C. G., Washington, D. C.; American Forestry Association.
- Crenshaw, R. C., Frankfort, Ky.; State of Kentucky.
- Curtin, Gen. G. W., Sutton, W. Va.; State of West Virginia.
- Craig, D. A., Washington, D. C.; Washington *Evening Star*.
- Crenshaw, A. P., Chesapeake & Potomac Telephone Co., Washington, D. C.
- Croft, A. J., Enosburg, Vt.; Vermont Maple Sugar Makers' Association.
- Cutler, J. H., Raleigh, N. C.; State of North Carolina.

D

- Davant, T. S., Roanoke, Va.; Norfolk & Western Railway Co.
- Davis, L. G., Saratoga, Wyo.; Wyoming Forest Reserve Service.
- Daw, N. L., Roanoke, Va.; Norfolk & Western Railway Co.
- Daish, John B., Washington, D. C.; National Hay Association.
- Davis, A. P., U. S. Geological Survey, Washington, D. C.
- Deal, J. T., Chairman, North Carolina Pine Association, Norfolk, Va.
- Deering, Hon. Frank C., Bedford, Me.; State of Maine.
- Defebaugh, J. E., Chicago, Ill.; Editor *American Lumberman*.
- Dezendorf, Mr., General Land Office, Washington, D. C.
- Dickinson, L. F., Greenfield, Mass.; National Association of Box and Box Shook Mfrs. of United States.
- Dill, Lewis, Baltimore, Md.; National Wholesale Lumber Dealers' Assn.
- Dixon, Hon. J. M., Washington, D. C.; Montana Stock Growers' Assn.
- Dock, Miss Mira L., State Forestry Commission, Harrisburg, Pa.
- Donnelly, J. W., General Land Office, Washington, D. C.
- DuBois, C. L., General Land Office, Washington, D. C.

- Durgin, Jno. C., Sandy Hill, N. Y.; Forest, Water Storage and Manufacturing Association.
- Drummond, A. T., Toronto, Canada; American Forestry Association.

E

- Eaton, Hon. Geo. H., Calais, Me.; State of Maine.
- Eberlein, Chas. W., Southern Pacific Railway.
- Eddy, J. R., Washington, D. C.; National Geological Park.
- Edmands, J. Rayner, Boston, Mass.; Massachusetts Forestry Association.
- Elliott, Howard T., St. Paul, Minn.; President Northern Pacific Ry. Co.
- Elliott, S. B., State Forestry Commission, Harrisburg, Pa.
- Emerson, Col. Geo. H., Hoquiam, Wash.; Pacific Coast Lumbermen.
- England, Charles, Washington, D. C.; National Hay Association.

F

- Faull, J. H., University of Toronto, Canada.
- Fellows, A. L., U. S. Geological Survey, Washington, D. C.
- Fenn, Maj. F. A., Kalispell, Mont.; Montana Forest Reserve Service.
- Fernow, Dr. Bernhard E., Ithaca, N. Y.; American Forestry Association from New York and Society for Protection of the Adirondacks.
- Fimple, J. H., General Land Office, Washington, D. C.
- Fischer, Fred C., Tryon, N. C.; National Lumber Manufacturers' Assn.
- Fisher, Prof. Richard T., Harvard University, Cambridge, Mass.
- Fisher, Wm. H., Cincinnati, Ohio; State of Ohio.
- Fitch, C. H., U. S. Geological Survey, Washington, D. C.
- Fletcher, Dr. Jas., Ottawa, Ontario, Canada; Canadian Forestry Assn.
- Foley, John, Bureau of Forestry, Washington, D. C.
- Foster, H. D., Washington, D. C.; American Forestry Association.
- Foster, N. C., Wisconsin Hardwood Lumbermen's Assn., Fairchild, Wis.
- Fowler, Hon. B. A., Phoenix, Ariz.; Territory of Arizona.
- Fox, Col. Wm. F., Superintendent of State Forests, Albany, N. Y.; Association for Protection of Adirondacks.

F

Franklin, Blake, General Land Office, Washington, D. C.

Freeman, Miss Harriet E., Boston, Mass., American Forestry Association from Massachusetts and Massachusetts Forestry Association.

Freeman, Hon. Wm. F., State Forester, Indianapolis, Ind.; Indiana State Board of Forestry.

Fulton, John, State Forestry Commission, Harrisburg, Pa.

G

Gannett, Dr. Henry, U. S. Geological Survey, Washington, D. C.; Sierra Club.

Gannett, Miss Mary C., Bureau of Forestry, Washington, D. C.; American Forestry Association.

Gardner, W. A., Chicago, Ill.; Chicago & Northwestern Railway.

Gardner, Wesley J., Bureau of Forestry, Washington, D. C.

Garrett, Robert, Baltimore, Md.; delegate-at-large from Maryland.

Garver, L. J., General Land Office, Washington, D. C.

Gaskill, Alfred, Bureau of Forestry, Washington, D. C.

Gennett, Andrew, South Carolina; State of South Carolina.

Gibson, Edgar, Clyde Park, Mont.; State of Montana.

Gilbert, Dr. G. K., Sierra Club, San Francisco, Cal.

Gilfry, H. H., Washington, D. C.; State of Oregon.

Gillenwaters, E. P., Glasgow, Ky.; State of Kentucky.

Girtanner, Jules, Linden, N. J.; American Forestry Association.

Goddard, Hon. Albert J., Tacoma, Wash.; Tacoma Chamber of Commerce.

Gosney, E. S., President Arizona Wool Growers' Assn., Flagstaff, Ariz.

Green, Dr. Samuel B., St. Anthony Park, Minn.; State of Minnesota and Minnesota State Forestry Assn.

Green, Prof. W. J., Agricultural Experiment Station, Wooster, Ohio; State of Ohio.

Grier, T. J., Superintendent Homestake Mining Co., Lead, S. D.

Griffith, E. M., Madison, Wis.; State Forest Service.

Grimes, E. P., Maine; State of Maine.

Grinnell, Henry, Bureau of Forestry, Washington, D. C.

Griswold, W. T., U. S. Geological Survey, Washington, D. C.

Grosvenor, Gilbert H., Washington, D. C.; American Forestry Assn.

Grunsky, C. E., Washington, D. C.; State of California.

Gwinn, J. H., Pendleton, Ore.; Oregon Wool Growers' Association.

H

Haas, L. G., Baltimore, Md.; Baltimore & Ohio Railroad.

Hagenbarth, F. J., National Live Stock Association, Denver, Colo.

Haines, A. S., Westtown, Pa.; Pennsylvania Forestry Association.

Hale, Dr. Edward Everett, Washington, D. C.; State of Massachusetts, Massachusetts Forestry Association, Appalachian Mountain Club.

Hall, Edward Hagaman, New York city; Association for Protection of the Adirondacks.

Hall, Geo. F., Chicago, Ill.; Chicago-Texas L. & L. Co.

Hall, James B., Clay City, Ky.; Beer Stock Manufacturers' Association.

Hall, Wm. L., Bureau of Forestry, Washington, D. C.; Hawaii Forestry Service.

Hansen, Prof. N. E., Agricultural College, Brookings, S. D.; State of South Dakota.

Happy, H. W., General Land Office, Washington, D. C.

Harrison, W. F., Norfolk, Va.; North Carolina Pine Association.

Harvey, Wm. S., Philadelphia, Pa.; Pennsylvania Forestry Association.

Hawes, Austin F., State Forester, New Haven, Conn.

Hawley, R. C., Amherst, Mass.; American Forestry Association from Massachusetts.

Hayes, C. W., U. S. Geological Survey, Washington, D. C.

Hayes, R. P., Asheville, N. C.; State of North Carolina.

Henry, Alfred J., Washington, D. C.; American Forestry Association.

Henry, H. D., Athens, Ohio; Union Association of Lumber Dealers.

Herndon, T. H., General Land Office, Washington, D. C.

Hightower, Clement, Capitan, N. M.; Territory of New Mexico.

H

- Higgins, S. M., Forester, Cleveland Cliffs Iron Co., Negaunee, Mich.
 Hinshaw, G. W., President Stone Mountain Ry. Co., Winston, N. C.
 Hobbs, Jno. E., North Brunswick, Me.; American Forestry Assn.
 Hodge, Wm. C., Jr., Bureau of Forestry, Washington, D. C.
 Hodson, E. R., Washington, D. C.; Iowa Park and Forestry Assn.
 Holcombe, E. P., General Land Office, Washington, D. C.
 Holdredge, G. W., Chicago, Ill.; Chicago, Burlington & Quincy Ry. Co.
 Holmes, J.; State of Connecticut.
 Holt, W. A., Oconto, Wis.; Northwestern Hemlock Mfrs. Assn.
 Holter, Norman, Helena, Mont.; State of Montana.
 Hoover, T. L., Carlisle, Pa.; Pennsylvania Forestry Association.
 Hopkins, Dr. A. D., Washington, D. C.; American Forestry Association.
 Hotchkiss, Geo. W., Chicago, Ill.; Lumber Secretaries' Bureau of Information.
 Hoyt, Colgate, New York city; Missouri, Kansas & Texas Ry. system.
 Hutcheson, David, Congressional Library, Washington, D. C.
 Hutchinson, James, Randolph, Vt.; Delegate-at-large.

I

- Imes, R. P., Washington, D. C., American Forestry Association.
 Irvin, Hon. Edw. A., Curwensville, Pa.; State of Pennsylvania.
 Irvine, Wm., Chippewa Falls, Wis.; Missi. Valley Lum. Assn.
 Ivy, Thos. P., Conway, N. H.; State of New Hampshire.

J

- Jackson, Luis, New York city; Erie Railroad Co.
 Jastro, H. A., Bakersfield, Cal.; Kern County Cattle Growers' Association.
 Jenks, Robt., Cleveland, Ohio; Lumbering.
 Jensen, A. W., Ephraim, Utah; Forest Reserve Service.
 Johnson, L. E., Roanoke, Va., President Norfolk & Western Ry. Co.
 Jones, Hunt, Louisville, Ky.; State of Kentucky.
 Jones, H. H., Washington, D. C.; General Land Office.

- Jones, William, Tacoma, Wash.; Chamber of Commerce.
 Justus, T. W., Baltimore, Md.; Baltimore & Ohio Railroad.

K

- Kalaniana'ole, Hon. Jonah K., Honolulu, Hawaii; Territory of Hawaii.
 Kaul, Jno. L., Birmingham, Ala.; Southern Lumber Mfg. Assn.
 Keen, Miss Florence, Philadelphia, Pa.; American Forestry Association.
 Keller, O. B., New York city; American Forestry Association from New York.
 Kellogg, J. C., Louisiana; State of Louisiana.
 Kellogg, R. S., Fay, Kan.; State of Kansas.
 Kelsey, Frederick W., Orange, N. J.; American Forestry Association.
 Killen, Wm. H., Milwaukee, Wis.; Wisconsin Central Ry. Co.
 Kinney, David G., Washington, D. C.; Bureau of Forestry.
 Kittredge, G. W., Cincinnati, Ohio; Cleveland, Cincinnati, Chicago & St. Louis Ry. Co.
 Knepper, David, Harrisburg, Pa.; Pennsylvania State Forestry Service.
 Koch, Elers, Washington, D. C.; American Forestry Association.

L

- Lamb, Hon. John, Richmond, Va.; State of Virginia.
 Langille, H. D., Santa Barbara, Cal.; Forest Reserve Service.
 Langworthy, C. F., Washington, D. C.; American Forestry Association.
 Lazenby, Wm. R., Columbus, Ohio; Ohio State Forestry Society.
 Leland, J. D., Washington, D. C.; General Land Office.
 Lewis, W. H., Washington, D. C.; General Land Office.
 Lippincott, J. B., Washington, D. C.; U. S. Geological Survey.
 Little, Wm. T., Perry, Okla.; American Forestry Assn. from Oklahoma.
 Loring, Hon. C. M., Minneapolis, Minn.; Minnesota Forestry Assn.
 Luebker, Otto, Washington, D. C.; American Forestry Association.

M

- McAllaster, Birdsall, Omaha, Neb.; Union Pacific Ry. Co.

M

- MacNaughton, James, New York city; American Society of Civic Engineers, New York Board of Trade and Transportation, and Association for Protection of the Adirondacks.
- McBee, Silas, New York city; Delegate-at-large.
- McCann, John A., Philadelphia, Pa.; Editor *National Coopers' Journal*.
- McClure, R. C., Silver City, N. M.; Forest Reserve Service.
- McCoy, Wilbur, New York city; Atlantic Coast Line Railroad Co.
- McKeithan, D. T., South Carolina; State of South Carolina.
- McKinney, J. M., Washington, D. C.; General Land Office.
- McLeod, N. W., St. Louis, Mo.; Southern Lumber Mfgs. Assn.
- Macbride, Thos. H., Iowa City, Iowa; State of Iowa.
- McNeeley, E. J., Tacoma, Wash.; State of Washington.
- McPhaul, John, Washington, D. C.; General Land Office.
- McVean, M. J., Washington, D. C.; General Land Office.
- Macey, J. T., Washington, D. C.; General Land Office.
- Maffet, Miss Martha A., Wilkesbarre, Pa.; American Forestry Association.
- Maher, N. D., Roanoke, Va.; Norfolk & Western Railway.
- Manderson, Gen. Chas. F., Chicago, Ill.; Chicago, Burlington & Quincy Ry. Co.
- Macoun, Prof. J. M., Canadian Geological Survey, Ottawa, Ontario, Canada.
- Manning, W. H., Boston, Mass.; American Forestry Association.
- Marr, S. S., General Land Office, Washington, D. C.
- Marston, Roy L., Yale Forest School, New Haven, Conn.
- Mason, S. C., Berea, Ky.; State of Kentucky.
- Mast, Wm. H., Halsey, Neb.; State of Nebraska.
- Mather, William G., Cleveland, Ohio; Cleveland Chamber of Commerce.
- Mathewson, Dr. Arthur, Woodstock, Conn.; Connecticut Forestry Assn.
- Mattoon, W. R., Washington, D. C.; American Forestry Association.
- Maxwell, Geo. H., Chicago, Ill.; National Irrigation Association and State of California.
- Mead, Elwood, Washington, D. C.; Department of Agriculture.
- Meekham, H. S., Washington, D. C.; American Forestry Association.
- Merriam, Dr. C. Hart, Geological Survey, Washington, D. C.; Sierra Club and American Forestry Association.
- Merrill, H. G.; American Forestry Association.
- Merry, Capt. J. F., Dubuque, Iowa; Illinois Central Railroad Co.
- Methudy, L., St. Louis, Mo.; National Lumber Exporters' Association.
- Miller, Prof. Frank G., Lincoln, Neb.; University of Nebraska.
- Miller, L. C., Washington, D. C.; Bureau of Forestry.
- Miller, W. H., Madison, Ind.; Retail Lumber Dealers' Association.
- Mitchell, Guy E., Washington, D. C.; American Forestry Association.
- Moore, M. C., Milwaukee, Wis.; Editor *Packages*.
- Mosle, M. A.; Delegate-at-large.
- Mulford, Walter, New Haven, Conn.; State of Connecticut.
- Murphy, J. T., Washington, D. C.; General Land Office.

N

- Nelson, John M., Jr., Rider, Md.; State of Maryland.
- Newhall, D. S., Philadelphia, Pa.; Pennsylvania Ry. Co.
- Newell, F. H., U. S. Geological Survey, Washington, D. C.
- Norris, Jos. L., Leesburg, Va.; State of Virginia.

O

- Oak, Hon. Chas. E., Bangor, Me.; State of Maine.
- Olmsted, F. E., Washington, D. C.; Bureau of Forestry.

P

- Pack, Charles L., Lakewood, N. J.; Cleveland Chamber of Commerce.
- Palmer, T. S., Washington, D. C.; American Forestry Association.
- Pammel, Prof. L. H., Secretary Iowa Park and Forestry Association, Ames, Iowa.
- Parsons, Mrs. Henry, New York city; American Forestry Association.
- Peavy, Geo. W., Washington, D. C.; American Forestry Association.

P

- Penrose, Dr. Chas. B., Philadelphia, Pa.; State of Pennsylvania.
 Perry, E. F., New York city; National Wholesale Lumber Dealers' Assn.
 Peters, J. Girvin, Washington, D. C.; American Forestry Association.
 Peyton, Miss J. S.; General Land Office, Washington, D. C.
 Pinchot, Gifford, Bureau of Forestry, Washington, D. C.; Bureau of Forestry, American Forestry Association, Sierra Club, South American Foresters, Society American Civil Engineers.
 Pinchot, James W., New York city; New York Chamber of Commerce.
 Pollock, G. F., General Land Office, Washington, D. C.
 Pope, J. W., Atlanta, Ga.; State of Georgia.
 Potter, A. F., Bureau of Forestry, Washington, D. C.
 Potter, H. G., General Land Office, Washington, D. C.
 Price, Overton W., Bureau of Forestry, Washington, D. C.
 Purington, Pres. D. B., State University, Morgantown, W. Va.; State of West Virginia.
 Putnam, H. C., Eau Claire, Wis.; Lumbering.

R

- Rane, Prof. F. Wm., Durham, N. H.; New Hampshire College, Boston and Maine Railroad, State of New Hampshire.
 Reed, Franklin W., Washington, D. C.; Society American Foresters.
 Richards, J. T., Philadelphia, Pa.; Pennsylvania Railway Co.
 Rinewalt, John M., Mt. Carroll, Ill.; Delegate-at-large from Illinois.
 Ring, Hon. Edgar E., Forest Commissioner, Augusta, Me.
 Ross, D. M., Boise, Idaho; U. S. Geological Survey.
 Ross, Norman M., Ottawa, Canada; Dominion Forest Service.
 Roth, Prof. Filibert, Ann Arbor, Mich.; State of Michigan, University of Michigan.
 Rothrock, J. T., Secretary State Forestry Reservation Commission, Harrisburg, Pa.
 Russell, I. C., Washington, D. C.; National Geographic Society.

- Russell, Jas. S., Boston, Mass.; Massachusetts Forestry Association.
 Russell, F. B., Beer Stock Mfrs. Association, Louisville, Ky.

S

- Satterlee, J. B., General Land Office, Washington, D. C.
 Savage, H. N., U. S. Geological Survey, Washington, D. C.
 Scaife, Marvin F., Pittsburg, Pa.; Pennsylvania State Forestry Assn.
 Schaperkotter, Jas. F., Philadelphia, Pa.; Lehigh Valley Railroad system.
 Schenck, Dr. C. A., Biltmore, N. C.; Biltmore Forestry School.
 Schwarz, G. Fred, New York city; American Forestry Association from New York city.
 Scott, Chas. A., Halsey, Neb.; State of Nebraska.
 Sebastian, Jon., Chicago, Ill.; Rock Island Railway system.
 See, Mrs. Horace, New York city; American Forestry Association.
 Seeley, J. B., Virginia City, Mont.; Forest Reserve Service.
 Shaw, A. C., General Land Office, Washington, D. C.
 Shaw, Eugene, Wisconsin Hardwood Lumbermen's Assn., Eau Claire, Wis.; Miss. Valley Lum. Assn.
 Sheller, D. B., Tacoma, Wash.; Washington Forest Reserve Service.
 Sherfesse, W. F., Charleston, S. C.; State of South Carolina.
 Shepardson, H. L., Baldwinville, Mass.; National Assn. of Box and Box Shook Mfrs. of United States.
 Sherman, W. F., General Land Office, Washington, D. C.
 Sherrard, Thos. H., Bureau of Forestry, Washington, D. C.
 Shields, G. O., Editor and Manager *Recreation*; League of American Sportsmen, Delegate-at-large.
 Shoemaker, Samuel M., Stevenson, Md.; State of Maryland.
 Silcox, F. E., Charleston, S. C.; State of South Carolina.
 Silvester, Pres. R. W., Maryland Agricultural College, College Park, Md.; American Forestry Association from Maryland.
 Smith, G. O., U. S. Geological Survey, Washington, D. C.
 Smith, H. A., Bureau of Forestry, Washington, D. C.

S

Smith, Geo. K., Secretary Southern Lumber Mfg. Assn., St. Louis, Mo.; Southern Lumber Manufacturers' Assn., National Lumber Manufacturers' Assn., Western Pine Shippers' Assn.

Snyder, J. M., Bay City, Mich.; American Forestry Association.

Spring, Preston B., Easton, Md.; State of Maryland.

Spring, Prof. Samuel N., Orono, Me.; University of Maine.

Start, Edwin A., Boston, Mass.; Massachusetts Forestry Association.

Steele, Henry M., Macon, Ga.; Central Georgia Ry. Co.

Sterling, E. A., Bureau of Forestry, Washington, D. C.

Sheller, R. H., Tacoma, Wash.; Forest Reserve Service.

Stewart, Elihu, Forestry Branch, Department of Interior, Ottawa, Ontario; Canadian Forestry Assn.

Stewart, Frank, Prescott, Ariz.; Territory of Arizona.

Strong, C. B., General Land Office, Washington, D. C.

Stout, J. H., Menomonee, Wis.; State of Wisconsin.

Strong, Miss L. M., General Land Office, Washington, D. C.

Sudworth, Geo. B., Bureau of Forestry, Washington, D. C.

Suter, H. M., Washington, D. C.; Editor *Forestry and Irrigation*.

T

Tennille, A. F., Washington, D. C.; *The American Lumberman*.

Thayer, Hon. Samuel R., Minneapolis, Minn.; Minnesota State Forestry Association.

Thomas, E. B., Los Angeles, Cal.; Forest Reserve Service.

Tompkins, H. J., Washington, D. C.; Bureau of Forestry.

Totten, Mrs. S. G., Washington, D. C.; General Land Office.

Toumey, Prof. J. W., New Haven, Conn.; Yale Forest School.

Tower, G. E., Washington, D. C.; American Forestry Association.

Tremaine, Morris, Buffalo, N. Y.; National Wholesale Lumber Dealers' Association.

U

Underwood, Geo. F., New York city; Water Storage and Manufacturing Association.

V

Von Schrenk, Dr. Hermann, Washington, D. C.; Bureau of Forestry.

Van Aiken, C. M., New York city; National Slack Cooperage Assn.

Vreeland, Robert, Frankfort, Ky.; State of Kentucky.

W

Wadsworth, W. A., Genesee, N. Y.; State of New York.

Walcott, Dr. Chas. D., Washington, D. C.; U. S. Geological Survey.

Walker, F. B., Washington, D. C.; General Land Office.

Walsh, Thos. F., Washington, D. C.; Denver Chamber of Commerce.

Wantland, C. E., Denver, Colo.; State of Colorado.

Ware, Miss Mary Lee, Boston, Mass.; Massachusetts Forestry Association.

Webster, Jr., N. E., Washington; U. S. Reclamation Service.

Weed, W. H., Washington, D. C.; U. S. Geological Survey.

Wells, Geo. T., Drifton, Pa.; American Forestry Association from Pennsylvania.

Weyerhaeuser, Jr., Fred E., St. Paul, Minn.; Weyerhaeuser Lumber Co.

and Miss. Val. Lumberman's Assn.

Wheeler, Mrs. C. H., Boston, Mass.; American Forestry Association.

White, J. B., Kansas City, Mo.; Southern Lumber Manufacturers' Assn.

White, J. W., Portsmouth, Va.; Seaboard Air Line Railway.

Whittlesey, Geo. P., Washington, D. C.; American Forestry Association.

White, Aubrey, Toronto, Canada; Canada.

White, H. D., Enid, Okla.; Territory of Oklahoma.

White, W. H., Warren City, Mich.; Hardwood Manufacturers' Assn.

White, T. Brook, Portland, Ore.; State of Oregon.

Wiggins, Vice-Chancellor B. L., Seawance, Tenn.; University of the South.

Williams, A. S., Berlin, N. H.; Berlin Mills Co.

Williams, F. B., Patterson, La.; National Lumber Manufacturers' Assn.

W

Williams, Irvin C., Harrisburg, Pa.; Forestry Academy and Pennsylvania Forestry Association.

Williams, Mrs. L. P., Minneapolis, Minn.; State of Minnesota.

Williams, Hon. M. M., Little Falls, Minn.; State of Minnesota.

Wilms, William, Chicago, Ill.; Hardwood Manufacturers' Association.

Wilson, H. M., Washington, D. C.; U. S. Geological Survey and American Society of Civil Engineers.

Winchester, A. H., New Orleans, La.; *Lumber Trade Journal*.

Winchester, Col. A. H., Buckhannon, W. Va.; State of West Virginia.

Wirt, Geo. H., Harrisburg, Pa.; Forestry Academy and Pennsylvania Forestry Association.

Witten, J. W., Washington, D. C.; General Land Office.

Wood, Richard, Philadelphia, Pa.; Pennsylvania Forestry Association.

Woodruff, Geo. W., Washington, D. C.; Bureau of Forestry.

Worden, F. E., Oshkosh, Wis.; Northwestern Hemlock Manufacturers' Association.

Z

Ziegler, E. A., Washington, D. C.; Salim Valley Telephone Co.

CONFERENCE OF RECLAMATION ENGINEERS

Important Session of Engineers who Have the Government's Irrigation Work in Charge

REALIZING the importance of the task before the United States Reclamation Service in their work of directing the provisions of the National Reclamation Act of June, 1902, Chief Engineer Newell called a conference of the engineers comprising the service, held in Washington January 3 to 14. The enormity of the task of administering equably the provisions of this Act, affecting immense areas of now arid and semi-arid land, and involving the expenditure of millions of dollars by the Government, is directly in charge of this body of engineers, and the conference in Washington—the second of its kind—was called in order that, by discussion of various phases of their work, and personal intercourse, with a view of further creating an *esprit de corps*, the engineers might be better equipped to cope with the problems before them.

The various subjects discussed included, besides irrigation in recognized relation to the arid lands, irrigation ditch, reservoir, and dam construction, water-laws and the distribution of water, alkali, drainage, cement, con-

crete, measurement of streams, hydro-economics, etc. For convenience in discussing details of work in various localities and on various subjects, the conference was organized in sections.

The sessions on the opening day included general conferences, with subdivisional meetings of hydrographers and with the Committee on Water-laws and Forms of Water Users' Associations. Mr. Asa Phillips, engineer of the Washington Sewer Department, addressed the general assembly on the concrete and cement constructive work carried on by his department in that city, and a brief address on the importance of the governmental reclamation work in Montana was made by Hon. Joseph M. Dixon, Representative in Congress from that state.

In the section meetings, the hydrographers discussed the limits of accuracy in reporting discharge measurements, in constructing rating tables, and in applying gage heights, introduced by Mr. R. E. Horton, of New York; and methods of counting seconds and revolutions in making low

water measurements, opened by Mr. John C. Hoyt, chief computer.

On the afternoon of the previous day, there was some discussion of the methods of preparing engineering estimates of the actual cost of work accomplished, and the details of the original records for obtaining the facts, in the section of costs and results, and in the general meeting on Thursday afternoon, Mr. Robert S. Person, Auditor for the Interior Department, with several of his assistants, continued in the same line, outlining the subject of auditing accounts.

The most important address of the meeting on Friday, January 6, was Mr. Cyrus C. Babb's discussion of the Milk River project in Montana and its international complications. The problem is a complex one, involving consideration by the state departments of both this country and Canada. Mr. C. J. Blanchard discussed the advertising side of the reclamation work, and suggested improvements in the present system of advertising for bids for construction.

A discussion of "Bench Marks" by Mr. E. Johnson, jr., hydrographer in charge of the Mississippi River district, occupied a meeting of hydrographers; and in the afternoon they were addressed on the subject of "Equipment for Cable Stations," by Mr. E. C. Murphy, inspector of stream gaging.

On Saturday the morning session was principally occupied in discussion of the Snake River Valley in Idaho, and addresses were made by Mr. D. W. Ross, who is in charge of the Government's work in that state, with brief addresses by Senators Dubois and Heyburn, and Representative French. Mr. E. C. Murphy discussed the "Cost of Stream Gaging" at the afternoon session, and Mr. Williams, representing Mr. Willis L. Moore, Chief of the Weather Bureau, made an interesting address. The Truckee-Carson project in Nevada was presented by District Engineer L. H. Taylor, of that state; and Mr. J. C. Hoyt contributed a paper on "The Study of Data by Local Men."

Mr. Thomas H. Means, engineer of

soils, and the foremost authority on alkali, presided over a section of the conference on Monday which discussed one of the most perplexing phases of irrigation work—that is, the duty of water, and the relation of alkali and drainage. The decision finally rendered with reference to the determination of farm units and the amount of water to be used is contained in the following set of rules adopted at the conference:

(1) The farm unit classification shall show in each farm unit the boundary of the irrigable land, and the area of the irrigable land, in acres.

(2) A water right application shall state the number of acre feet per annum to be furnished per acre.

(3) The charge for water rights shall be the same per acre of irrigable land.

(4) The land shall be classified into two grades, irrigable and non-irrigable, and all farm units shall contain the same area of irrigable land as nearly as practicable, except in the case of areas near towns and those susceptible of growing more valuable crops, thus providing for two sizes of irrigable areas in the farm units. The maximum number of acres of irrigable land fixed for each class in a project shall be adhered to as closely as possible.

(5) The charge per acre for water rights on private land shall be the same as for public land, and the irrigable land in each tract shall be determined in the same way as for public land, the irrigable area allowed one man in no case to exceed 160 acres.

The duty of water as generally determined supplies the engineer with the information upon which he can base the size of his storage reservoirs or the amount of land which he can irrigate with his given supply of water. In the design of canals for the delivery of this water, and pumping plants, it becomes necessary, in addition, to know the rate and time of delivery of water to the lands. In each irrigation district there is usually one time of the year when water is used in larger quantities than at any other time in the year. The determination of this time and the maximum amount of



RAYMOND M. ALLEN



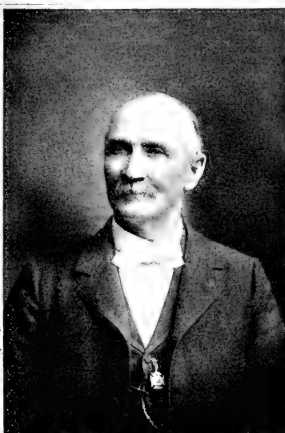
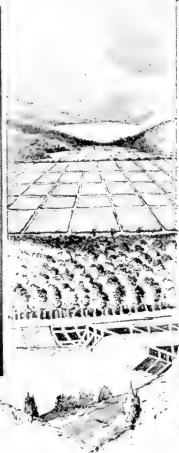
A. M. CORBETT



D. J. EGAN



EDWARD T. PERKINS
Engineer and Auditor.



W. D. SANDERS
Civil and Mechanical Engineer.



J. N. SAVAGE
[Supervising Engineer for Northwest.]



T. J. SOLOWAY



J. D. QUINTON
Civil and Mechanical Engineer.

water which should be delivered are important in order that the canals can be designed of the proper capacity and pumping plants be given the size and power sufficient to supply the right amount of water needed by the crops.

On the same day, the Belle Fourche project in South Dakota was outlined to the general assembly by Mr. Raymond F. Walter, who has the work in charge. The chief engineer, Mr. Newell, in executive session with the supervising, consulting, and district engineers and experts, discussed the broad principles of construction and cost and the relations which the co-ordinate branches of the service bear to each other. Discussion in detail of constructive work was entered into by the committee on cement and concrete. Computer J. C. Hoyt also discussed the work of the computing section. Stress was laid upon the vital correlation of forestry and irrigation, and the work of the Bureau of Forestry, by Chief Engineer Newell.

By invitation of Chairman Mondell, the conference met the House Committee on Irrigation on Tuesday, and discussion of the Klamath project in California and Oregon was undertaken, Mr. J. B. Lippincott, supervising engineer, of California, leading. Congressional action is necessary to divert the waters which it is intended to use, and the House Committee, which has the bill under advisement, and which is desirous of securing all available information, took advantage of the opportunity of securing all possible data from the engineers in direct charge.

Washington reclamation work was discussed by Mr. T. A. Noble, and the Shoshone project in Wyoming by Mr. H. N. Savage, the former in the morning session, and the latter in the afternoon. Two sections of the conference—the Committee on Water-laws and Forms of Water Users' Associations, and the Committee on Electric Power, Development and Pumping—convened during this session, and discussed the particular phases of the reclamation work they represented.

The entire board of engineers were received by President Roosevelt on Wednesday at 12:15, and the sessions

on that day were given over principally to committee and section conferences, there being no general assembly until 3:30, when the photographic laboratory of the Survey was visited.

Perhaps the most interesting session of the conference occurred on Thursday, when the North Platte (Wyoming and Nebraska) and the Pathfinder projects were discussed at length by Mr. John E. Field, engineer in charge; and details of the work in Wyoming described by Mr. H. N. Savage. The afternoon was devoted to two committee conferences, with the Committee on Methods of Reconnaissance and Survey, and the Committee on Transportation. The latter committee was appointed to go into the matter of railroad rates on the movement of cement and supplies for reclamation work. In the evening, the conference was tendered a reception by its chief engineer, Mr. F. H. Newell, at his home.

On the evening of January 13, the engineers met the employees of the Survey at a smoker tendered them by the Survey. Many distinguished public men were present, and considerable enthusiasm was aroused. The evening's entertainment was purely social, with songs, speeches, and talks by Survey employees and others.

At the closing session of the conference on Saturday, Mr. J. J. Hill, president of the Great Northern Railway, addressed the engineers. Mr. Hill spoke interestingly of the irrigation work, its splendid progress under individual efforts and under the paternal irrigation act, and eulogized the profession of engineering. By invitation, Senator Bard, chairman of the Senate Committee on Irrigation, the chief engineer, and principal supervising and constructing engineers appeared before the committee and discussed several bills of importance to the reclamation work. The rest of the day's session was occupied in final closing discussions of the objects assigned committees and sections, and a general summing up by Mr. Newell.

The American Forest Congress, which was in session during the first week of the conference, was attended

on different occasions, when papers were presented which had particular reference to irrigation. The close relation existing between the forest and the water supply being recognized, several of the engineers were speakers at the Forest Congress, and at such times nearly the entire conference was in attendance, and particularly when Mr. Newell, Mr. A. P. Davis, Mr. Morris Bien, Mr. A. L. Fellows, and Mr. J. B. Lippincott delivered their respective addresses.

The value of the conference to the engineers of the Reclamation Service will be incalculable. The old adage that two heads are better than one is also applicable where there is more than one head to be helped, and more than two to offer suggestions and assistance. Every minute detail of the governmental reclamation work was gone over and discussed thoroughly, and the importance and value to the cause of irrigation in the conferences with the House and Senate committees on irrigation is significant. It shows the interest of the legislative bodies in the governmental reclamation of arid land, and their desire to obtain data

not corrupted or tainted by the land-grabber and schemer.

The list of engineers present included Mr. Arthur P. Davis, assistant chief engineer; Mr. J. B. Lippincott, supervising engineer for California; Mr. H. N. Savage, supervising engineer for Northwest; Mr. J. H. Quinton, consulting engineer; Mr. W. H. Sanders, consulting engineer; Mr. O. H. Ensign, electrical expert for the Pacific coast; Mr. H. A. Storrs, electrical expert for Rocky Mountain region; Mr. Morris Bien, supervising engineer and legal adviser; Mr. Thomas H. Means, engineer of soils; Mr. Charles H. Fitch, supervising engineer, and chairman of Auditing Committee; Mr. Edmund T. Perkins, engineer and auditor; Mr. George A. Hammond, superintendent of drilling; Mr. Louis C. Hill, supervising engineer, Arizona; Mr. I. C. McConnell, Colorado; Mr. D. W. Ross, Idaho; Mr. Cyrus C. Babb and Mr. S. B. Robbins, Montana; Mr. J. E. Field, Nebraska; Mr. L. H. Taylor, Nevada; Mr. Raymond F. Walter, South Dakota; Mr. T. A. Noble, Washington.

REPORT OF THE DIRECTORS OF THE AMERICAN FORESTRY ASSO- CIATION, 1904

THE Board of Directors of The American Forestry Association, in accordance with its custom, begs to submit the following report, which is intended to be a resumé of the more striking events in connection with the development of forestry in the United States during the preceding year, and a review of the status of the forestry movement in the United States at the present time.

No better indication of the advance of the ideas which this Association has stood for and labored to advance during the past twenty-three years could be shown than the holding of such a meeting as this Congress, where repre-

sentatives of all interests having to do, either with the *production* or the *use* of forests, have gathered from all parts of the land to see in what way this fundamental necessity of national life may be promoted. When this Association was organized, hard-headed business men looked upon it as an organization composed largely of sentimentalists, and it is only within a comparatively few years that the great consumers of forest products have realized that we advocate not forest preservation only, but forest preservation by wise use. But economic laws in this country, as everywhere else, have worked out their inevitable re-

sult, so that with diminishing supplies the importance of an economical use of the forest is now widely recognized, and we may reasonably claim that public sentiment now so strongly sustains all sound movements for forest preservation that we need fear no abandonment or diminution of the forest policy inaugurated by the United States and the various states. When the first great federal forest reservations were proclaimed in the far West, the opposition to them by the people in the various localities where they were created was well-nigh unanimous. Today we can point to an almost complete reversal of this sentiment. In no small part is this due to the appreciation that water conditions can best be maintained by preservation of the forests, and with the growing importance of irrigation the strength of the support of the forest reservation policy will also grow.

The most important facts in connection with the development of forestry in the United States during the last year are: First, the steady and rapid progress which commercial forestry is making in consequence of the growing recognition by lumbermen that conservative lumbering offers definite business advantages, to which, as business men, they must give careful consideration, and that the day is rapidly approaching when the failure to practice forestry will mean for many of them the extinction of their business; second, the substantial advance which has been made toward securing forever for the people those portions of the public lands which will make their largest contribution to the public welfare as permanent forests; third, the recognition by many of the states, who have not been interested heretofore, of their duties and opportunities in respect to the maintenance or extension of their forests, resulting in definite and comprehensive state forest policies.

MEMBERSHIP OF THE ASSOCIATION.

With the growth of forestry in this country, this Association also must grow; or, to state it in what was certainly the true terms until 1896, this

Association by its efforts in no small part brought forestry before the public and its practice into existence here, and so grew itself with the growing interest in the subject.

The enthusiasts of the '80's numbered only between two and three hundred, and their propaganda seemed almost hopeless. But the work did tell in time, and the Association steadily grew, until we now number ten times what we did fifteen years ago.

A year ago our annual membership amounted to 1,970. Through deaths, resignations, and those dropped for non-payment of dues or otherwise, we lost during the past year 173, and we gained 262 new members, making the net gain in annual membership for the year 89 members, so that our annual membership on December 1, 1904, was 2,059. Adding to these: Sustaining members, 17; Life members, 121; Patrons, 2, we had at that date 2,199 members. This membership is scattered throughout the country, every state and territory except one being represented. A gratifying feature of the past year has been the considerable number of Forest officers who have joined the Association. As we have often stated before, we ought to have 10,000 members, and the only way we can obtain such membership is through the active co-operation of all of our members. We have made arrangements for a campaign during the coming year, by which it is hoped we may add several thousand to our membership. The influence of such a body of public-spirited citizens actively exercised in behalf of forestry cannot be overestimated, and we should make every effort to largely increase our membership; for, steady as has been the growth of the Association, it still falls far short of a membership commensurate with the national importance of the forest movement which it advocates.

WORK OF THE BUREAU OF FORESTRY.

The activities of the Bureau of Forestry are so numerous, varied and far-reaching that it is impossible in a report of this character to more than touch upon a few of its most important

acts. The growth and usefulness of the Bureau has been phenomenal, and especially gratifying is the wide public recognition of the fact that this is a practical bureau as well as a scientific one. Lumbermen and forest owners are engaged in a practical business, and for them forestry is of interest and importance only as a question of business. The Bureau, recognizing this fact, has put itself in close and useful touch with both the producers and consumers of the forest.

The Bureau has received applications for assistance from land owners, who desire to secure for their forest holdings the best care, covering total areas of 8,000,000 acres. It now has under its management 20,000 acres in woodlots and 500,000 acres of timber tracts, while working plans have been prepared by the Bureau for 823,000 more acres, and working plans are now in preparation for an area aggregating 3,578,514 acres. The tracts involved are widely scattered, including lands in the Southern pine regions, the Lake State pineries, the Pacific Northwest, and the broad-leaf forests in the lower Mississippi Valley.

The advance of forestry where economic and commercial advantages are involved is rapid, for the larger private interests are keenly alive to whatever promises to be of value to them, and are able to look forward into future conditions. With the owners of small forest acres, whose woodlots constitute a vast area when considered in the aggregate, forestry takes hold slowly. They must be convinced of the benefits afforded them by its practice, and so the forester must go to them. When the time comes, however, that sound methods of cutting on the woodlots have established themselves in the traditional practice of farming handed down from father to son, we shall see an enormously increased production for such woodlands. The Bureau of Forestry, recognizing that this is a matter of prime importance and directly in line with the purposes for which the Department of Agriculture was created, has entered this field with the definite purpose of continuing in it until woodlot management shall have

become as truly a part of farm practice as skillful methods of securing field crops.

EXAMINATIONS OF NATIONAL FOREST RESERVATIONS.

The forest reservations of the United States at present afford the greatest single opportunity for the introduction of the practice of scientific forestry; and the importance of properly fixing their boundaries and examining the character of timber growth within them cannot be overestimated. In this work the Bureau of Forestry has continued during the past year to perform the excellent service of previous years. The creation of new reserves and additions to old reserves require the expert examination of the foresters from the Bureau, before being finally proclaimed by the President, and the wise practice of withdrawing temporarily such areas as seem probably of such a character that they should be made forest reservations upon recommendation of these officers, gives good ground for confidence that the nation will not lose the forest lands which it ought to guard through any lack of early information.

In connection with the reservations of the government, forest planting and experiments therein have been continued under the direction of the Bureau with a view to arriving at such methods as will reduce the cost to such a basis as to make this feasible on an extensive scale, where the same is needed within the forest reservations. Another line of work of the utmost importance is the continued investigation of the Bureau in connection with the available supply of timber for railroad ties. The question of a cheap and still abundant material for this purpose, in view of the rapidly dwindling supplies, grows more important every year. With this aim in view, the study of the loblolly pine, which has been carried on in many parts of the South, was taken up in Texas, where the great area of young growth of loblolly pine furnished for this purpose an unexcelled opportunity.

This investigation considered the questions of raising tie timber of this

character as a permanent investment, and the possibilities of avoiding waste in tie-making, as well as the introduction of economical methods of management of loblolly pine forests for ties. These studies promise to prove of great practical value.

In co-operation with several of the great railroads, the Bureau of Forestry is conducting other studies, both of the sources of supply of railroad ties and construction timbers and of the best methods for their preservative treatment. These studies offer tangible promise of economy by railroads, both through the use of the inferior timbers, rendered possible by preservative treatment, and also through the application of conservative methods in the woods, thus decreasing materially the drain upon our forests.

The methods of turpentine orcharding introduced by the Bureau in the South have brilliantly justified themselves. It is estimated that the Bureau's service in this line has added to the annual naval stores' product an increased value of \$7,000,000, and at the same time removed the greatest single cause of the destruction of the turpentin orchards. The total amount expended in accomplishing this result was but \$14,000.

SCIENTIFIC WORK OF THE BUREAU OF FORESTRY.

Upon the scientific side the Bureau of Forestry has continued its investigations to determine the strength and durability of the merchantable timbers of the United States. These mechanical tests have been carried on at Berkeley, Cal.; Lafayette, Ind.; New Haven, Conn.; St. Louis, Mo., and Washington, D. C., where the properties of red fir, western hemlock, red gum, long-leaf pine, and loblolly pine have been and still are under investigation. Reliable data on the structural value of the timber of the country is limited, and the purpose of these investigations is to supply engineers and architects with complete information on the mechanical properties of merchantable timbers, showing the effect of natural defects on the strength of the timber, the rate of growth, and the

moisture content to the strength, especially as applied to the larger timbers. Such a work must necessarily occupy a series of years, but when completed will be of inestimable value.

The year 1904 saw several new seasoning stations established in different parts of the country, where extensive investigations are now being conducted as to the seasoning and preservation of timber. Particular attention has been paid to determining the effect of treatment with various preservatives upon the strength of timber, and it has been shown that the preliminary steaming usually practiced reduced the strength of timber materially, and also that the preservative itself has much the same effect upon the strength of timber that water has.

SALES OF TIMBER.

No better argument for the repeal of the Timber and Stone Act, and in lieu thereof the passage of legislation authorizing the sale of matured timber upon the public lands generally, could be wished for than is to be found in the results obtained from the sales of timber on the Chippewa Indian Reservation in Minnesota. Under special provisions of the act authorizing the disposition of this timber, it was to be advertised and sold to the highest bidder, after a careful estimate of the timber on these lands had been made, and no bid was to be accepted for less than the estimated value of the timber. The results of this method were that the timber was sold at the first sale, December 5, 1903, at an average price of \$13.90 per acre, and at the second sale, December 28, 1903, at an average price of \$16.70 per acre, the average price of both sales being \$15.06 per acre for the timber alone, the title to the land being retained by the government for subsequent disposition. Under the Timber and Stone Act both land and timber would have been sold for \$2.50 per acre. That is, the government has received, or will receive, from these sales of timber \$2,650,903; while under the Timber and Stone Act it would have received only the sum of \$438,707 for both land and timber. In this connection it must not be forgotten that

under the second sale 5 per cent. of the timber was reserved for the purpose of insuring the reforestation of this land.

What was accomplished in connection with the sale of this Indian timber can just as well be accomplished with reference to the matured timber on the public domain. To effect this, however, the Timber and Stone Act *must* be repealed.

We also commend the proposition that contemplates the passage of such legislation as will authorize the establishment of national parks, for the purpose of preserving natural wonders, by proclamation of the President, in much the same way as the forest reservations are now proclaimed under the Act of March 3, 1891.

FOREST FIRES.

Were it not that the importance of the subject demands it, we should pass over the well-worn and tiresome subject of the destruction wrought by forest fires. In the press generally, as well as in forestry publications, the wanton waste of our timber resources from this cause, far exceeding in the total all legitimate consumption, has been dwelt upon year after year; and yet this loss still continues, when increased care would reduce it materially.

To take only the reported fires of the past three months, we find that they have raged in the following states:

Oregon suffered severely in September and October by numerous fires. One fire is reported by timber men to have destroyed \$8,000,000 worth of timber in Columbia county.

Washington had numerous destructive fires during the same two months, in one case a detail of troops from Vancouver Barracks being ordered out to assist in suppressing the fire. At the head of Lake Washington some 7,000 acres were burned over.

In Montana fires of considerable size occurred in all of the past three months, in some cases clearly due to carelessness, and much game was destroyed and driven from the forests.

California has also been a severe

sufferer, as fires from all parts of the state were reported in September, October and November, in one case the Government Forestry Experiment Station in Santa Monica Canyon being injured to the extent of \$5,000.

Arkansas sustained probably the greatest losses in November of any of the states.

Not to go into detail, Indiana, Illinois, Ohio, Kentucky, Missouri, Tennessee, Texas, Colorado, Idaho, Georgia, Virginia, West Virginia, Pennsylvania, New Jersey, Kansas, and Indian Territory all report losses of greater or less magnitude.

FOREST WORK OF THE GENERAL LAND OFFICE.

As is well known, at present, the General Land Office, under the supervision of the Secretary of the Interior, is charged with the responsibility of administering and protecting the Federal Forest Reservations. This has grown to be a very important part of the work of that office, and the Commissioner's annual report deals extensively with the subject. Considering that this branch of the service has only been in operation for the past six years, and that it had to be created *de novo*, we feel that the office is entitled to our commendation for what it has done in the face of very great difficulties.

The Forest Reserves of the United States now number sixty-one, and embrace a total area of 63,348,656 acres, being an increase in the area of forest reserves since June 30, 1903, of 585,162 acres. During this period there have been eleven new forest reserves created, and one has been abandoned (the Crow Creek Forest Reserve, in Wyoming). The areas of four reserves have been somewhat reduced, two have been enlarged, and two have been consolidated. To properly administer this vast area requires constant patrolling to suppress incipient fires and to apprehend timber trespassers. Under the appropriations for this purpose during the past year it has been possible to employ at any one time 484 rangers as the highest number, who were placed in the field at the

periods when danger from fire was greatest. During the winter months many of these were furloughed, so that at one time the number employed was only 200. A comparison of the figures showing the enormous acreage of these reservations and the number of rangers now employed in protecting them must show to anyone how inadequate the existing force is. This is especially true when we consider that means of rapid communication within the reservations are very slight and growing less. Formerly the trails were kept open by those travelling through the regions now in reservation on business of various sorts. Such travel decreases after the reservations are created, and as a consequence the roads and trails become less passable owing to fallen timber and other obstacles. Recognizing the necessity for rapid communication within the reserves, this Association passed a resolution at its annual session, in December, 1903, calling upon Congress to appropriate \$500,000 to be used in the improvement of roads and trails within the forest reservations. The matter was presented to Congress by the Secretary of the Treasury, with recommendations of the Secretaries of Agriculture and the Interior that an appropriation of \$50,000 be at once made for this purpose, but too late in the session to obtain favorable action. It is earnestly hoped that some appropriation for this purpose may be made by the present Congress.

That the Forest Rangers are very successful in extinguishing fires appears from the report of the General Land Office, which shows that during the past year 231 fires which had passed the incipient stage were extinguished—a decrease from the prior year of forty-eight in this class of fires. Owing to the constant patrolling, the number of fires passing the incipient stage diminishes year by year.

The grazing privilege within the forest reservations is one of the most valuable to the public, and at the same time one of the most difficult to administer, keeping in view both the purposes of the reservations and the general public good. Under the system

now prevailing of issuing permits, when it is shown that such grazing will not injuriously affect the young growth of timber on the reservations, there seems to have been devised a fairly satisfactory plan. There have been issued 843 permits to graze 1,806,722 head of sheep in twenty of the reservations, and 5,822 permits to graze 610,091 head of cattle and horses in forty-eight of them. Sixteen conditional permits to graze sheep to the number of 38,100 in the Washington Forest Reserve were issued by the Secretary of the Interior, which were not to be delivered unless the Forest Superintendent found that the grazing areas desired by the sheep owners could properly be so used. Six permits were also issued to allow 16,100 head of sheep to cross reserves in order that they might reach private lands within the Sierra Forest Reserve. In furtherance of the determination of the department not to allow the forest reserves to interfere with the transaction of any proper business, permits of a temporary character have been granted allowing stock to cross certain reserves to reach necessary shipping points and for other proper purposes.

A bill providing for the punishment of persons pasturing stock within forest reservations without a permit has been recommended by the Secretary of the Interior, and some such measure should certainly be passed. Other legislation necessary for the good administration of the reserves is that authority should be conferred upon forest officers to make arrests for violation of the laws and regulations relating to forest reservations. Such a measure was introduced in the House of Representatives at the last session of Congress (Bill H. R. No. 7396) and received favorable action in that body. It is to be hoped that the Senate will pass this bill before the adjournment of the present Congress.

SALES OF TIMBER WITHIN FOREST RESERVATIONS

The policy of selling the mature, dead, and down timber within the forest reservations has justified itself and is constantly increasing. During the

past year 377 sales have been effected, from which \$58,436.19 were realized from such sales; in addition to which there is now a large amount arising from such sales in the hands of the receivers of public monies at the local land offices. This is the largest amount thus far sold since such sales were authorized. These sales, combined with the privilege allowed settlers to take without cost for their individual use timber from the forest reserves for domestic purposes, have resulted in clearing the reserves of much dead and down timber, and in every way improved their condition. A much larger revenue might be obtained from the forest reservations if grazing and other privileges, such as the location of saw mills, hotels, summer resorts, etc., within the reservations were made to pay a reasonable amount for such privileges. This Association has always contended that the forest reservations of the United States could and ought to be made self-sustaining, and that all the revenues derived therefrom should be expended in developing the reservations with the idea of constantly improving the character of the forest and thus insuring adequate timber supplies for future generations. We therefore urge that all monies derived from the sale of timber on forest reservations, or revenues of any description from the sale of privileges within the reservations should be set aside as a special fund in the Treasury of the United States, to be paid out upon proper requisition of the head of the department administering the reserves to be expended for the improvement of the reservations.

We also wish to renew our recommendations, contained in the resolutions which were adopted at the annual meeting of this Association in December, 1903, concerning the modification of the mineral land laws, of the lieu land-selection law, and the repeal of the Timber and Stone Act.

CONSOLIDATION OF FOREST WORK OF THE UNITED STATES.

When there is such unanimity of opinion as exists concerning the necessity of consolidating all the forest

work of the Federal Government in the Bureau of Forestry, it seems hardly possible that the necessary legislation should be much longer delayed, and we have great gratification in reporting that a bill for transferring the management and control of the United States Forest Reserves from the General Land Office to the Bureau of Forestry passed the House of Representatives at this Congress on the 12th of December, 1904. With the President, both the Secretaries of Agriculture and of the Interior, and the Commissioner of the General Land Office, all uniting to urge this legislation, we may reasonably expect that the Senate will concur in making the proposed legislation a law. (Query: Does the present bill provide for anything more than the transfer of the reserves to the Bureau of Forestry?).

IRRIGATION.

General interest in the work of the Association has been greatly stimulated in the West through the active surveys and construction of large works of reclamation under the terms of the Act of June 17, 1902. This Act sets aside the proceeds of the disposal of public lands, about \$25,000,000 at present. This money is being used in the construction of large irrigation works, the cost of which is to be returned to the government in ten annual installments and the money used over again. The necessity of protecting these works from floods and from the washing of earth from the hillsides has emphasized the need of good forest management. It is believed that in the future the work of the Association will be of very great advantage in the carrying out of the purpose and intent of this Reclamation Act.

FOREST WORK OF THE STATES.

As indicative of the growing interest and strength of the forestry movement, the co-operation of the Bureau, at the request of the states, with the states of California, Massachusetts, and New Hampshire is significant. In California the joint work of the state and the Bureau of Forestry in studying its forests has been completed and

a model state forest law has been drawn. The co-operative study of the White Mountain region of New Hampshire has been completed.

Without attempting to recite what is being done in all the states, the achievements of the state of Pennsylvania, which was among the earliest to appreciate the importance of the forest problem, are noteworthy. During the past six months that state has purchased over 100,000 acres of land for forest purposes, making such state holdings now aggregate about 600,000 acres; and it is the purpose of the state to procure a million acres at the earliest possible moment. The State Forest Academy, which has been in existence only two years, has at this time twenty students preparing for practical forest work of the state. Upon the philanthropic side the state has in this connection established a Camp Sanatorium with gratifying results.

Wisconsin and Massachusetts are following a definite forest policy through the employment of state foresters under forest acts passed at the last sessions of their legislatures. Maine, with the aid of the Bureau of Forestry, under her Forestry Commissioner, is solving her urgent forest problems.

In Michigan, under the previously established Forest Commission, forestry has made great advances during the past year. Forest reserves on lands derived from tax sales have been created, amounting to 35,000 acres, where a regular system of fire protection, with rangers and foresters, has been inaugurated under the warden of the reserves, who is the professor of forestry at the State University. Planting, road construction, fire lines, the regulation of grazing, are also in successful operation on these reserved lands. The interest of the people of the state is now sufficiently aroused to promise the passage of needed regulation.

The most important step taken in New York state is the passage of a law conferring authority to employ fire patrols to any number needed in anticipation of fires at dangerous periods in

the state reserves. Planting is also being done on the state lands and will be extensively continued this year.

PHILIPPINES.

The forest work done in the Philippines is a good example of what we might have done with the timber lands of the Public Domain. The Forestry Department there, established only four years ago, last year obtained a revenue from the sales of timber of \$300,000, or four times as much as the greatest amount obtained while under Spanish rule. The department now has sixty permanent stations scattered throughout the islands, and employs 230 men.

CANADIAN FORESTS AND FORESTRY.

The great area of timbered land in Canada, estimated at 300,000,000 acres of merchantable timber, demands our attention. The value of the exports of wood and manufactures thereof for the fiscal year ending June 30, 1903, was, in round numbers, \$40,000,000, and of this about \$19,000,000 worth came to the United States, or \$100,000 more than what was exported to Great Britain. Within recent years forest reserves have, at different times, been set aside by the Dominion government, and also by some of the provinces. At present the aggregate area of Dominion reserves is about 18,700,000 acres. A system of patrol for protecting the forests against fire, both within and outside the reserves, is now in operation both on federal and provincial land and has proved of great value in lessening the annual loss from forest fires.

FOREST TREE PLANTING ON THE PRAIRIES.

In the Spring of 1901 a commencement was made in forest tree planting on the plains in Manitoba and the Northwest Territories under a system of co-operation between the federal government and the settlers, and is being attended by excellent results. Over 3,000,000 trees have been planted, and of this number 1,800,000 were planted in 1904.

AFFILIATION WITH OTHER FORESTRY ASSOCIATIONS.

While a number of efforts to effect some consolidation of state associations with this Association have been made during the past year, no practical method of accomplishing this very desirable purpose has been developed, and it is hoped that during this Congress, where so many state associations are represented, some plan may be formulated for the establishment of closer relations of state and local forestry organizations with this Association. A special committee of this Association is prepared to submit a tentative plan, having this object in view, at a special meeting of those interested, to be held in connection with this Congress.

THE MAGAZINE.

In creating an official organ the Association took a wise step. Through our magazine, FORESTRY AND IRRIGATION, we are able not only to keep our members in touch with the forestry movement, but it is also valuable in constantly obtaining new members and in widening the sphere of our influence. During the past year 3,000 copies per month were issued and regularly sent to all of our members, the surplus being used in obtaining new members and in endeavoring to interest others outside of the Association. The total cost to the Association was \$3,509.25.

FOREST SCHOOLS.

The increase both in the number of forest schools and of the students in attendance is a sure indication of the growing interest in Forestry. The fact that it now offers a career for young men makes certain that the needed men will be trained, and there will be use for the training.

At the Yale Forest School, now the oldest distinctively forest school since Cornell University abandoned its forest school, there are sixty-three students in attendance. These students are also joined at Milford, Pa., by those of the summer school of the university for practical forest work during the summer.

The Harvard Forest School has been doing successful work during this, its second, year.

At Biltmore, N. C., Dr. Schenck continues his forest school in connection with the Vanderbilt estate, having fifteen students this year. An extensive tract, some 15,000 acres, is to be reforested by stock raised on the estate.

Michigan Agricultural College has fifteen men taking the full forestry course and twenty-three men doing elementary work in forestry in the freshman class; while at the University of Michigan Professor Roth reports an increased attendance of forest students over last year.

The University of Maine has forty-five undergraduates taking a course in forestry, some of whom intend making it their profession.

In the Iowa State College of Agriculture and Mechanic Arts additional courses have just been established in response to the increased interest in forestry.

The University of Minnesota now offers a full four-year course in forestry, with a degree of equal importance to those granted for other sciences by the university.

By these opportunities, and those furnished in other schools and colleges, men are being prepared all over the country to take charge of private forest properties, or for government service at home or in the Philippines, where the United States early established a forest service, or to act as teachers in what is to us a new science and art.

This necessarily abbreviated review of the forest work of the past year, it seems to us, can have only one impression, and that is, how vigorously this subject has taken hold of our people and how certainly it will grow from year to year.

What this Association had at first to fight for—to obtain any recognition of the necessity for its existence—is so well assured that it can now only hasten to its perfect consummation.

And so we close this report with words of congratulation to our members for what they have accomplished.

REPORT OF THE TREASURER

For Fiscal Year ended November 30, 1904.

Otto Luebker, Treasurer, in Account with the American Forestry Association.

DR.		CR.	
To Balance, December 1st, 1903....	\$488 72	By "Forestry and Irrigation," December, 1903, to November, 1904, inclusive.....	\$3 509 25
Interest on bonds.....	180 00	Postage.....	150 00
Interest on deposits.....	19 54	Salary of Treasurer and clerk hire.....	219 35
Dues, annual memberships.....	3,646 03	Interest on demand loan.....	25 25
Dues, sustaining memberships.....	350 00	Expense of summer meeting, Minneapolis, 1903.....	50 00
Life memberships.....	400 00	Printing and stationery.....	264 80
Donations.....	3 00	Payments on demand loan.....	800 00
Exchange on remittances.....	2 69	To bank, to make good a bad check (Contra).....	4 00
To make good a bad check (Contra).....	4 00	Refund of dues, overpaid.....	2 00
		Sundries.....	8 25
			<hr/>
			\$5,032 90
		Balance, December 1, 1904.	61 08
			<hr/>
	\$5,093 98		\$5,093 98

Special Fund for Secretary.

DR.		CR.	
To balance, December 1st, 1903....	\$1,500 00	By Edward A. Bowers, for Secretary's expenses.....	\$500 00
Contribution, Elizabeth S. Potter.....	1,000 00	Expenses American Forest Congress, Washington, January 2-6, 1905.....	500 00
Interest on deposit.....	31 75		<hr/>
			\$1,000 00
		Balance December 1, 1904.	1,531 75
			<hr/>
	\$2,531 75		\$2,531 75

Additional Assets.

DR.		CR.	
Two Chicago and Eastern Illinois 5 per cent bonds (purchase price)	\$2,305 00	Balance of loan on one Chicago and Eastern Illinois bond.....	\$200 00
Two Minneapolis and St. Louis R. R. 4 per cent bonds (purchase price).....	1,982 50	Net additional assets subject to realization.....	4 901 50
Dues outstanding—			
Annual membership.....	764 00		
Sustaining memberships.....	50 00		
	<hr/>		<hr/>
	\$5,101 50		\$5,101 50

It will be seen from the Statement of Receipts and Disbursements that the Demand Loan, which was \$1,000 at the beginning of the year, has been reduced to \$200. It will be apparent from the foregoing that while the cash balance at this date is about \$400 less than a year ago, an actual *gain* of about \$400 has been made during the year.

Unpaid dues to the amount of \$814 are outstanding. Namely, for annual memberships \$764 and Sustaining memberships \$50. The Annual dues outstanding are as follows:

For 1904.....	\$532 00
For 1903.....	228 00
For 1902.....	4 00
	<hr/>
	\$764 00

One Sustaining Member, elected the latter part of the fiscal year 1903, was credited with 1903 dues paid.

On March 1, 1904, 40 members were dropped for non-payment of dues, the amount thus lost being \$200

Respectfully submitted,

OTTO LUEBKERT,
Treasurer.

WASHINGTON, D. C., *December 1, 1904.*

CONFERENCE OF FOREST OFFICIALS

Valuable Meetings at Washington of Members
of General Land Office, Forest Reserve Officers,
and Representatives of the Bureau of Forestry

DURING the week immediately following the Forest Congress, a series of daily conferences were held at the residence of Mr. Gifford Pinchot between the forest supervisors who were attending the Congress, members of Division R of the General Land Office, and members of the Bureau of Forestry. The object of the conferences was to discuss the various problems arising in connection with the administration of the forest reserves; to get an exchange of ideas between the field and office force; to suggest necessary changes in the regulations, and in general to talk over the details of the field work and devise plans for its improvement.

Among the men participating in the conference were the following: Inspectors H. D. Langille and R. H. Charlton, Superintendents Maj. F. A. Fenn and D. B. Sheller, Supervisors

Frank Stewart, of the Prescott Forest Reserve, Arizona; J. B. Seely, of the Madison Forest Reserve, Montana; L. G. Davis, of the Medicine Bow Forest Reserve, Wyoming; A. W. Jensen, of the Manti Forest Reserve, Utah; F. S. Breen, of the San Francisco Mountains Forest Reserve, Arizona; R. C. McClure, of the Gila Forest Reserve, New Mexico; Clement Hightower, of the Lincoln Forest Reserve, New Mexico; E. B. Thomas, of the San Bernardino Forest Reserve, California. Also Mr. H. H. Jones, chief of Division R; J. T. Murphy, J. D. Leland, Capt. J. B. Satterlee, Blake Franklin, of the General Land Office; and Mr. Pinchot, F. E. Ohmsted, E. T. Allen, Overton W. Price, T. H. Sherrard, C. Dubois, Hareford, Hatton, Elers Koch, Franklin W. Reed, H. J. Tompkins, G. E. Tower, Wilson, and A. F. Potter, of the Bureau of Forestry.



LECTURES ON FORESTRY

Special Course Given in Washington,
January 7--13, by Yale Forest School

TAKING advantage of an unusual opportunity for bringing its students into touch with the leaders of the forest movement, the management of the Yale Forest School held a series of interesting lectures in the assembly hall of the Bureau of Forestry, Washington, D. C., January 7 to 13. The students of the school had attended the American Forest Congress the week previous, and remained over for these lectures as part of their regular work. In addition, the various members of the Bureau of Forestry and the delegates to the Forest Congress were invited to attend these lectures.

Mr. Gifford Pinchot, forester of the United States Department of Agriculture, delivered a series of four exceedingly valuable lectures on "Forest Policy." On the opening day, January 7, in addition to Mr. Pinchot's lecture, Captain George P. Ahern gave an interesting talk on the Philippines. There were also impromptu addresses of interest and value from Dr. B. E. Fernow, Prof. Filibert Roth, and Dr.

Judson F. Clark, of the Canadian Forest Service.

Five lectures on "Hydrography," illustrated with lantern slides, were given by Mr. F. H. Newell, chief engineer of the Reclamation Service. On Monday, January 9, Mr. Frederick V. Coville, botanist of the United States Department of Agriculture, and Mr. A. F. Potter, grazing expert, Bureau of Forestry, spoke on the "Grazing Problem." "Forest Reserves" were discussed by Mr. F. E. Olmsted on Tuesday, January 10. On January 11 Mr. George B. Sudworth lectured on "Dendrology," while Mr. T. H. Sherrard spoke on "Bureau Methods," his talk being supplemented with addresses by Mr. H. H. Chapman, Mr. A. K. Chittenden, and Mr. C. S. Chapman, all of the Bureau of Forestry. Two lectures worthy of special mention were delivered on January 12, by Mr. William L. Hall, whose subject was "Forest Extension," and by Mr. Raphael Zon, on "Silvicultural Research."

SOUTHERN APPALACHIAN FORESTS

Cooperative Study of their Resources and Needs Made by State of
North Carolina, U. S. Geological Survey, and Bureau of Forestry

THE forest conditions of a large area in the Southern Appalachian Mountains were examined in 1900 and 1901 by H. B. Ayres and W. W. Ashe, of the United States Geological Survey. The examination was made at the joint expense and under the joint supervision of the United States Geological Survey, represented by Mr. Henry Gannett, geographer; the Geological Survey of North Carolina, represented

by Prof. J. A. Holmes, state geologist, and of the Bureau of Forestry of the Department of Agriculture, represented by Mr. Gifford Pinchot, forester. The report made by Messrs. Ayres and Ashe has recently been published by the United States Geological Survey and contains much matter of general interest.

The portion of the Appalachian region under consideration extends from

Virginia southwestward, and comprises parts of North and South Carolina, Tennessee, and Georgia, between the Piedmont Plateau on the southeast and the Appalachian valley on the northwest. It consists of two parallel mountain chains, the Unaka on the northwest and the Blue Ridge on the southeast, and the intermediate mountains and valleys, some parallel, others at right angles to the Blue Ridge. The region examined in 1900 and 1901 comprises an area of approximately 10,000 square miles between New River Gap in Virginia and Hiwassee River in western North Carolina and northern Georgia, and has an approximate length of 190 miles and a varying width of 35 to 65 miles. The forests in this area have an important influence on the climate and the supply of water and timber in all the territory between the Ohio River and the Atlantic and Gulf coasts. Whatever concerns the forests is, therefore, of economic interest, not merely to the 318,000 people who live in this region, but to a population far beyond its borders as well.

The distinctive factors which give value to this mountain region are a temperate and healthful climate; grand and varied scenery; a plentiful supply of cool water; abundant water power; mineral deposits of iron, copper, mica, talc, gold, corundum, precious stones, kaolin and other clays, and building stone; soils that are generally of good physical and chemical composition; and a vast extent of forest, principally hardwood, consisting of 137 species of trees, many of which yield lumber and bark. Up to the present time these resources have been developed by individuals in a wasteful and unsatisfactory manner.

The original forest of this region, as indicated by the preserved remnants and by the accounts of old settlers and early explorers must have been won-

derful in the extent, density, size, and quality of its timber trees, and the variety of its species. The agencies that have wrought changes in these forests are fire, lumbering, clearing of lands for farming, and the grazing of cattle and sheep.

Evidence of forest fires is found over approximately 4,500,000 acres, or 80 per cent. of the entire area. Great damage has been done, year after year, by light fires that have scorched the roots of timber trees, destroyed seedlings so that the forest cannot reproduce itself, consumed forest litter and humus, and reduced the thatch of leaves which breaks the force of the rain.

The lumberman is growing more active in this region, going every year farther into the forest. In most places, however, the continuity of the forest has not yet been broken, as only the most valuable of the trees have been taken out.

Surpassing both fire and lumbering in the completeness and permanency of the damage done is the clearing for ordinary agricultural purposes of mountain lands which are not worth cultivating and should forever remain in forest. A few years of cultivation usually exhausts these lands and they are soon abandoned. Denuded of their forests they are rapidly washed away.

Great damage is also done to the forest by grazing cattle. Young growth has been prevented, and the hardening of the ground and the removal of debris and humus have promoted a rapid run-off of rain and water and prevented its percolation into the ground as a reserve for dry times.

If the best methods of silviculture were applied at once, the remaining forest would undoubtedly yield handsome returns. The most pressing need of the region is railroads, which would make the timber accessible.



STATE IRRIGATION LAWS

BY

MORRIS BIEN

Consulting Engineer, U. S. Reclamation Service

If the operations of the Reclamation Service have done nothing else, their effect in developing an active movement toward the improvement of the irrigation legislation of a number of the arid states would be considered a great achievement for the short period of its existence. The inauguration of a large system of development by federal authority for the construction of irrigation works in the various states and territories of the arid region has shown to the people in general, as nothing else could, the absolute necessity for improvement in the methods of acquiring title to the use of water and in protecting such rights. The states of Wyoming, Nebraska, and Utah had taken action in this direction before the passage of the Reclamation Act.

The time between the passage of the act and the next meeting of the various legislatures was but six months, so that but little opportunity was available for perfecting plans in this direction. However, the officers of the Reclamation Service were frequently asked during that winter to suggest improvements in legislation. Experience under the Reclamation Act had been so limited that conditions had not sufficiently developed to form the basis of definite recommendations and suggestions.

NEVADA LEGISLATION.

Nevertheless, the State of Nevada immediately took steps in this direction as a result of the passage of the Reclamation Act, and with commendable promptness passed an irrigation law which incorporates many valuable provisions looking to the definite ascertainment and protection of rights to the use of water.

OREGON AND WASHINGTON IRRIGATION COMMISSION.

During the early part of last year commissions were appointed in Oregon and Washington to formulate plans for state irrigation codes to be reported to the legislatures of the two states. These commissions conferred with the members of the Reclamation Service and many others interested in this line of work and have developed codes which are now before the legislatures of the two states. It has not been possible to give these drafts careful study at the present time, but the indications are that the code presented to the legislature of the State of Washington will, with some modifications which it is hoped will be adopted, serve admirably as a basis for the irrigation development of the state. Less is known of the action of the Oregon commission, but it is believed that it will submit a well-considered draft to the legislature.

NORTH DAKOTA AND SOUTH DAKOTA.

The legislature of North Dakota has had presented to it the draft of an irrigation code formulated along lines which it is believed will put the state among those having the most advanced irrigation legislation. Similar efforts are being made by members of the legislature in South Dakota, and the prospects are also favorable in that state.

MONTANA AND OKLAHOMA.

In Montana the subject is receiving considerable attention and it is possible that legislation to improve its irrigation laws will result.

In Oklahoma as well, has this spirit of improvement in irrigation legislation been aroused, and this young and

vigorous commonwealth will doubtless do effective work in this line through its present legislature.

Even in states whose irrigation codes are considered as being up to the standard of modern development, amendments for further improvement are under consideration and will doubtless be passed.

NEW IRRIGATION LEGISLATION.

New legislation will be required, however, in nearly every one of the states in order to facilitate the operations of the Reclamation Service in several of its various lines of work, involving changes which are necessary to remove obstacles appearing in the local laws which were formed in the absence of such a movement as now exists under the Reclamation Act for large mutual corporations to manage and control extensive irrigation works and to distribute great supplies of water.

PRESIDENT ROOSEVELT'S MESSAGE OF 1901.

The striking point of interest in considering this subject is the earnest ef-

fort in each of the states and territories of the arid region to carry out the sentiment of the message of President Roosevelt which was sent in December, 1901, to the Congress which passed the Reclamation Act, which pointed out the need for these changes in irrigation laws, and which sounds the keynote of modern development in irrigation legislation:

"In the arid states the only right to water which should be recognized is that of use. In irrigation this right should attach to the land reclaimed and be inseparable therefrom. Granting perpetual water rights to others than users, without compensation to the public, is open to all the objections which apply to giving away perpetual franchises to the public utilities of cities. A few of the western states have already recognized this and have incorporated in their constitutions the doctrine of perpetual state ownership of water."

The strength, directness, and accuracy of this declaration by the President should not be lost sight of in the present activity along these lines.

POCONO PROTECTIVE FIRE ASSOCIATION

Description of an Interesting Pennsylvania Organization that Has Achieved Good Practical Results in Fighting the Forest Fire Evil

BY

THOMAS L. HODGE

THE Pocono Mountain, which occupies a considerable part of Monroe and a small portion of Wayne county, Pennsylvania, embraces roughly two hundred thousand acres of land. This was originally covered with hemlock forests, the last of which were cut down twenty-five or thirty years ago. Some of this land has been covered by

a second growth of timber; much of it, however, has been burned over every few years, so that most of the trees which are left are of very inferior quality, principally bull pine, scrub oak, fire cherry, and sumac. These fires have been so frequent that in places even the sod has been destroyed, the earth being baked and cracked, so that it has been

blown away by the wind, leaving nothing but blackened, broken stones. Under such conditions any natural reforestation is, of course, impossible, there being no soil in which seeds could germinate.

The principal causes of fires in this locality are three in number:

(1) Those caused by sparks from locomotives, there being two railroad lines on the mountain.

(2) Negligent fires, caused by hunters and campers, who throw away lighted cigars and ashes from pipes, and leave camp fires unprotected.

(3) Incendiary fires. These have hitherto been the most serious, and were mostly started by berry-pickers who depend to a great extent for a livelihood on picking the huckleberries which grow in large quantities on this mountain. As is well known, these bushes do not bear well after they are three or four years old, and, to encourage the younger growth, the old bushes are burned off. These people never concern themselves about the damage done to other property, their only thought being the conservation of the berry crop. Consequently, such fires have often extended over thousands of acres of land, destroying much property.

With the view of preventing and effectually fighting fires, in the fall of 1902 the owners of upwards of one hundred thousand acres formed what is known as the Pocono Protective Fire Association, a regularly chartered organization. Under the provisions of the law, which provides for the appointment of deputy constables by the court upon the application of a certain number of citizens, they secured the appointment of deputy constables in each of the seven townships in which the association operates. These men have all the powers of fire wardens, with authority to call on any men in the community to assist in fighting fires. The fact that these men are appointed by the court, and are, therefore, not dependent upon the votes of their fellow-citizens for their election,

makes them independent in their actions, and they are of much more service to the association than the regularly elected constables. They are paid \$10 per month for the three months in the year in which there is the greatest danger from fire, viz: April and May in the spring, and October in the fall. Of course, they are expected to be watchful at all other times, and to extinguish any fires which may occur. In two or three cases large land owners have gratuitously given the services of their employees who have been appointed deputy constables. The association also makes itself responsible for the payment of the men who may be called out by their wardens to fight fires, instead of making them look to the county commissioners for compensation, which otherwise would be necessary. The promptness with which these claims are paid makes men much more willing to leave their work and respond to calls for aid.

Immediately upon organization, the association offered a reward, first of \$50, and then \$100, for information leading to the arrest and conviction of any persons starting fires, or for such information as could be used as evidence against the railroad companies. Publicity was given to these rewards by standing notices in the newspapers circulating through the district, and by muslin signs tacked on trees along the road and in conspicuous places in the woods. In addition, the association, through its attorney, notified owners of timber lands which were being cleared that they would be held responsible for any damage caused by fires which might occur in tree tops or other rubbish on their operations and spread to adjoining lands. Fortunately, there has been no occasion to make this threat good.

The expenses are met by an annual assessment of six mills per acre of land owned by the members. The officers receive no pay, the money being used for the payment of legal expenses in securing appointments, paying the

wardens and men assisting them, printing, etc. The charge per acre is so small as not to be a burden on any one, especially on the owners of small tracts, amounting as it does to but sixty cents per one hundred acres of land. Notwithstanding the insignificant pecuniary contribution, effort is made to secure the co-operation of the owners of small lots, the idea being that the greater the number of members the greater and more extended will be the interest in the work of the organization.

A novel method of fighting fires has been adopted in this region by the use of the ordinary hotel fire extinguisher. A number of these are put in a wagon, with barrels of water, and taken to a fire. One man running at top speed with an extinguisher can put out or check fifty feet of fire before exhausting it. When this is empty another is ready at hand for use, and the men following are able to beat out what fire remains. We do not know that this has been done elsewhere, but we have used these extinguishers with signal success.

The association has just completed the second year of its existence. During the first year there were but two fires not directly traceable to the railroads. All the fires which occurred during the second year were proven to have been caused by the railroads, but fortunately none of them was of a very

serious nature. As a result of our efforts to secure evidence against these companies, one of them has taken the precaution to burn all the grass, etc., on its right of way, and for some distance beyond, so that the danger from this source is minimized.

The practical result, therefore, of the two years' work has been the creation of a public sentiment against these promiscuous fires, as well as a wholesome respect for the association, backed as it is with its officers and members, with the necessary money at their disposal to prosecute all offenders. There have been but two incendiary fires in the two years, both of which were caused by persons seeking revenge. There have been no negligent fires which have not been put out by those who started them, and the railroad companies have been forced to clean their right of way to a greater extent than heretofore. Thousands of acres have thus been saved from devastation, which in time, if protected from fire, will gradually be reforested by natural means, if not by scientific methods. All this has been accomplished by an expenditure of less than \$900 for the two years.

While the work of the Pocono Protective Fire Association has been somewhat limited in area, the principle on which it works is one of general application.

GIVING MEN HOMES ON LAND*

A Discussion of the Sociological Phases of the
Campaign for Irrigation and Homebuilding

BY

GUY ELLIOT MITCHELL

Secretary The National Irrigation Association

THE minds of many thinking men are running in these days toward looking to the improvement of the social conditions of the laboring man through placing him upon a small

piece of ground, where he may make his home and from its products become to an extent independent of his daily wage. A large number of organizations have sprung into existence within

*Paper read before the American Association for the Advancement of Science, Philadelphia, Dec., 1904.

the past few years to accomplish this purpose, and although there has been no national movement as yet crystallized, the idea of Homes for Workers, Working Men's Gardens, Home Acres for Factory Employees, and the like has taken root in a great number of localities. In Europe, where the danger of congestion of factory hands is much more acute than in this country, the matter has received wider attention. An international congress in Paris last year discussed the subject of extending the work of allotting plots of agricultural ground to working men. Belgium had at that time provided 600 tracts in which plots had been allotted to 3,000 persons, and France 6,100 tracts which had provided assistance to 43,000 persons. A prominent American sociologist has during the past year, in a series of addresses, advocated the plan of providing home-acres for factory employees, and further propounded the radical plan that employers should arrange for a double shift of workers, each to work in the factory half a day and devote the other half to producing a living from his acre of ground. This, he contended, would give the laborer an opportunity to produce a living for himself and his family from the soil and save his rent, two items which, according to the statistics of the Government Labor Bureau, eat up more than fifty per cent. of the wages paid the American working man. At the same time, he maintained, the factory employer would secure greater labor returns, while the semi-independence created for his employees would largely reduce, if not entirely do away with, the strike problem. He advocated where possible the application of irrigation to these home-acres and presented facts and figures to show that one acre of good, irrigated land, tilled by an industrious man, will produce a far better living for himself and family than can be purchased by sixty per cent. of the average wage earning of the American factory hand.

IRRIGATION A HOME-CREATOR.

The educational features of the na-

tional irrigation movement have a direct bearing upon this subject. The primal effect of this law will be the creation of great numbers of small homes out of worthless land in the West, and as this work progresses year by year the feasibility of applying irrigation to the eastern or humid portion of the United States will come to be generally recognized. The social side of irrigation, wherever practised, can be described in the single clause:

Irrigation subdivides and re-subdivides lands into small home tracts.

The most highly developed irrigated communities average the smallest farms in the world. The West to-day contains thousands of five and ten-acre farms from which men are making comfortable livings. In Utah, where some very large ranches, thousands of acres in extent, are included, the census figures show the farm unit to be twenty-seven acres. Many notable examples could be cited where men have for years sustained themselves and families upon single acres. Two years ago I stood upon a commanding eminence overlooking the community of Riverside, in Southern California, the home of the famous Riverside navel orange, and viewed 22,000 acres. This panoramic display, where it seemed that almost every house was within a stone's throw of its neighbor, suggested to me some immense suburb of a city. The vast congregation of small homes was self-supporting; churches and school houses occurred frequently, good roads prevailed throughout the valley, and the residents enjoyed almost every privilege and advantage of an urban community, while at the same time they lived, worked and reared their children in the pure air and under the blue sky of heaven with none of the discomforts or unwholesome conditions to be found in the cities; and all this created by the artificial use of water out of land which twenty-five years ago was valued for stock-grazing purposes at \$1.00 an acre. A hundred similar examples could be cited in Southern California. The social con-

ditions of these intensely irrigated tracts are recognized by writers and travelers to be perhaps the most nearly perfect of those of any community in the world.

AN EMPIRE OF NEW HOMES.

Now, the effect of the great Government irrigation work, which contemplates the ultimate reclamation of some hundred million western acres—twenty times the area now irrigated—in small tracts, and which is being pushed rapidly forward, will be to create a western empire of new homes, and at the same time to incidentally educate the people of the entire country on the subject of irrigation.

The consequence of this will be that irrigation practices will gradually but finally enthrall the eastern farmer. The facts as they exist in European countries show that irrigation can be practiced with great profit upon land which has sufficient natural rainfall to grow paying crops. Irrigation is, in fact, a crop-insurer, besides producing doubles yields, and when it shall be applied to eastern farm lands, where the conditions of water supply are much better than they are in the West, the same conditions will result which are found in the arid region—the farm will be divided into smaller and better tilled tracts. With the prosecution of the government irrigation policy and its great agricultural educational features, must surely come the establishment of rural colonies throughout the entire country, home-acres for factory employees, and the gradual trend of the present inclination toward city congestion, away from the tenement and back to the land as the primal source of all wealth.

CHANGE NECESSARY IN EDUCATIONAL SYSTEM.

Necessary to, and working along with this policy of intensive farming and high cultivation, is found a movement to engraft a practical agricultural education, nature study, and handicraft work upon our common school system, so that the working man of the coming generation will both want and

strive to own a home on a piece of land, and when he secures it will have some knowledge of how to make it productive and attractive. It is becoming a well-recognized fact that our present system of school education leads the boys and girls away from rather than back to the soil.

A DISCORDANT NOTE FROM THE WEST.

While the movement is thus gaining headway throughout the East to accomplish this result, and the eastern business men will doubtless vie with the philanthropist and the student of sociology to make the United States a country of small home owners, the speculative idea is still dominant in many sections of the West, where large tracts of land are still unreclaimed and unsettled. The national irrigation law is distinctively in its construction a conservative eastern measure, although it applies to western lands. Its provisions are rigid, requiring actual settlement of Government irrigated lands in small tracts by men who will live upon them and farm them, and various schemes are continually being evolved to evade its spirit and that of the old homestead law, requiring five years of residence as an evidence of good faith, fathered by Galusha A. Grow and signed by President Lincoln. Other laws have crept upon the statute book and are to-day in force which admit of the absorption of great tracts of land into single ownership, without improvement and without home-building.

PERILS IN LAND MONOPOLY.

At the recent National Irrigation Congress at El Paso, Senator Newlands, of Nevada, who originated the fundamental principle of the national irrigation law, sounded a note of warning to this country on the danger of land monopoly—a really live danger, he contended, to-day confronting the people of the United States, through the operation of their land laws. Under the timber and stone law, the commutation clause of the homestead law, the desert land law, and the forest scrip law, enormous tracts of western lands have been, and are to-day, being

absorbed into great individual tracts and held for speculative and stock-grazing purposes. I speak from personal knowledge and observation when I assert that in some of the western states tracts of land are owned and held in blocks of thousands of acres, many of which could be subdivided into 80 and 160-acre tracts, each supporting a family in as great comfort and plenty as the most productive tract of similar size in the fertile Mississippi Valley states. These lands have been taken, under the above-named land laws, out of the public domain of the United States, and to-day support only a few head of stock, or lie entirely idle.

The fact that many western men contend that the abrogation of these maleficent laws would retard the "development of the West" is of no significance other than to accentuate the fact that western land men are more interested in immediate personal benefit than in the creation of a great empire of small agricultural homes.

FAILURE TO ENFORCE THE LAND LAWS.

For years and years, after valiant but futile endeavor to administer these laws in such manner as to prevent fraud, Commissioners of the General Land Office, Secretaries of the Interior, and even Presidents of the United States have recommended to Congress their repeal, as constituting a menace to the present and future wellbeing of the nation; yet it is a sinister fact that sufficiently strong influences have been exerted upon Congress to prevent any radical action. It is true that some ten years ago there occurred what purported to be a grand overhauling of the land laws whereby several pages of revision and reform were placed upon the statute book; but it soon transpired that the powers of the land grabbers had been in no way curtailed. The official statement of the present Secretary of the Interior two years ago that, aside from the sociological features of the question, over one hundred million dollars in actual cash value had been lost to the people of the United States through the operation of the timber and stone law, is sufficient evidence of

the gigantic operations of the men who are opposing any change in our land system.

This is not an alarmist's statement; it is a fact, readily substantiated and which is well-known and admitted by every man who is personally familiar with the public land conditions in the West.

As against this policy of tremendous land operations the efforts of eastern organizations and associations looking to the creation of improved opportunities and facilities for the poor man who desires to get a piece of ground and a home are all but futile. While it may not be practicable at this time to provide for the movement of a great number of poor people out of the cities onto the lands of the West—although this is being demonstrated in a small way with considerable success by the Salvation Army—it is in reality the surplus man in any community who depresses that community. There are thousands of men in the East who have saved up some little money and who would to-day gladly escape from daily and precarious wage earning and go out upon the land and relieve the pressure, if they knew where to go and how to turn. It will be a comparatively easy task to show them the way to the fertile lands of the West, as they are developed, provided the lands are not previously absorbed by the speculator. Not the least important, therefore, of the many "paramount" questions before the American people to-day is the saving of our great western land resource for real settlement and the aversion of the dangers of land monopoly.

Nothing affects social conditions more than the subdivision of tracts of land, all the way from the great ranch of a hundred thousand acres into small free-hold farms, down to the division of the five-acre suburban tract into acre homes. The question is broadly national; it is one which, properly worked out, will solve many of our most perplexing problems, and one which opens to its students higher and broader vistas the more deeply and aggressively it is studied.

STRENGTH OF TIMBER TREATED WITH PRESERVATIVES

Effect of Preliminary Steaming, and of Different Preservative Chemicals and Processes Upon Both Green and Seasoned Timber

WITH the increasing use of timber, preserved in one way or another against decay and fire, it is important to determine the effect which the preserving process has upon the strength of the preserved timber. Many engineers believe that creosoted timber is more brittle and less capable of withstanding strains than the same timber before being treated with creosote. This is particularly true with bridge timbers and piling.

Actual tests are necessary to determine what relationship exists between the preservative process and the strength of the timber. Most of the tests hitherto made with preserved timber were made by comparing results on treated sticks with results on untreated sticks. In many instances these turned out in favor of the untreated timber. The reason why such tests are unfair to the preservative is that in the process of preservation two factors enter: (1) The actual process of impregnation with a preserving substance, and (2) the preliminary processes of steam seasoning, in the majority of treating plants in the United States. A piece of timber subsequently treated with creosote may be steamed to such an extent that the timber becomes exceedingly brittle. This, obviously, will be the fault of the steaming and not of the creosote.

Timber preservation divides itself broadly into three stages: First, the preliminary preparation; second, the actual preservative process, and, third, the treatment of timber following preservation. The final strength of the timber may be influenced materially by each of the stages.

The Bureau of Forestry has erected an extensive plant on the grounds of

the St. Louis Exposition for carrying on a series of investigations of the methods for preserving timber, and of the influence various preservative processes have upon the strength of the timber. These investigations have been organized and outlined by Doctor Herman von Schrenk and Doctor W. K. Hatt, of the Bureau of Forestry.

This general plan was pursued during the last few months at the timber treating and testing station at St. Louis in accordance with the following outline:

(1) To determine the effect of the preliminary processes, such as steaming, on the mechanical properties of the timber.

(2) To determine the effect of preservatives on the strength of timber, eliminating the effect of the preliminary processes.

In order to determine the effect of these factors, the program was divided into two parts—part 1, the effect of the preliminary process, and, part 2, the effect of preservatives.

The effects of the preliminary process were determined only on loblolly pine. Both green and seasoned timber was used in determining the effect of preservatives. The preservative fluids investigated included only creosote and zinc chlorid.

In making comparative strength tests of treated and untreated timbers, it is necessary to eliminate as far as possible the variations due to the great differences in quality of individual pieces of wood. This was accomplished in this case by using 11-foot timbers cut at the same time from one forest site. In testing the influence of preliminary processes of seasoning, a three-foot section was cut from one

end of each timber and sawed up into test pieces, which furnished a basis of comparison between (1) the results of tests on these "control" pieces, and (2) the results on test pieces taken from the remaining eight-foot section after the latter had been subjected to the various preliminary processes in the treating cylinder.

In testing the effect of preservatives themselves the entire 11-foot timber was subjected to the preliminary seasoning processes, after which a three-foot section was cut from the end of each timber. The three-foot section thus having been subjected to the preliminary seasoning processes formed a basis of comparison with the remaining eight-foot section, which was treated with the preservatives. In this way the separate effects of the preliminary processes and the effects of the preservatives could be isolated and determined.

Because of an apprehension that defects of brittleness of treated timbers might not be evidenced by the ordinary tests under slowly applied loads, provision was made for both static tests and impact tests. The test pieces were subjected to crossbending strain, compression along the grain under both static and impact conditions, and under shearing parallel to the grain and compression at right angles to the grain under static conditions. The data taken include the moisture conditions, specific gravity, and rate of growth. During the treating operations, records were kept of the temperature to which the timbers were subjected at all stages, the amount of water lost or gained, and of the amount of preservatives absorbed, as indicated by gross weight and subsequent chemical analyses of the test pieces.

Ordinarily the strength tests were made immediately after treatment in the cylinder. In order, however, to determine what weakness might be introduced by changes in the physical condition of the preservatives in the wood through lapse of time, a com-

plete series has been set aside for subsequent operations. An additional set of test pieces has been loaded with different percentages of the strength, as exhibited under the ordinary tests, and this load allowed to act for long periods of time, the deflections being measured from day to day.

While this program is not sufficiently advanced to allow the drawing of final conclusions, yet the preliminary results are fairly indicative of what may be expected. It is found that the steaming process weakens the resistance of the wood fiber to both static and impact loadings. It may be stated that this diminution of strength is very nearly in direct proportion to the length of time that any given steam pressure is applied. The diminution of strength was found to be 25 per cent. after a pressure of twenty pounds was applied for ten hours to green loblolly pine, and 10 per cent. when a pressure of twenty pounds was applied for four hours. This diminution of strength increased very rapidly when the pressure rose above twenty pounds and amounted to about 25 per cent. when a pressure of fifty pounds was applied for four hours.

It will be easily seen that when the conditions of time and pressure are made very severe, the conditions prevailing in a pulp mill industry will be approximated. Evidently it is well to avoid when possible the use of these preliminary steaming operations in the wood-preserving industry.

With relation to the effect of preservatives themselves, the latter is distinct from the preliminary process. It may be said that the treatment with zinc chlorid does not seem to further reduce the strength of timber beyond the effect of the steaming process. This might have been expected when it is considered that the strength of the zinc chlorid solution ordinarily used does not exceed $2\frac{1}{2}$ per cent. The strength of timber that had been treated with the $2\frac{1}{2}$ per cent. solution of zinc chlorid after having been steamed four hours at twenty pounds pressure was the same as that of timber which

had been steamed without the subsequent application of zinc chlorid. The same statement may be made of timber treated with an 8½ per cent. solution of zinc chlorid. It may be that subsequently the crystallization of the zinc chlorid will weaken the wood fiber. This remains to be determined.

The effect of the creosote appears to be the same as that of an equal amount of water in weakening the fiber. That is to say, the strength of creosoted timber is that of green timber. The difference is that while green timber gains strength upon seasoning, the creosote oil remains in the wood, and, it appears from analysis of a pile thirty-five years old, that the oil remains

in a liquid condition. Consequently, comparison between seasoned timber and creosoted timber will always result to the disadvantage of the latter as far as its strength is concerned. In the case of creosoted wood, it also remains to determine what changes in the wood fiber take place through lapse of time in the presence of creosote oil.

It is expected that a bulletin will be issued upon the results of these investigations when the tests are completed. This bulletin will also contain the results of the investigations to determine the best methods of preserving wood so that the maximum impregnation may be obtained with the least expenditure of oil per cubic foot of timber.

TREATING TELEGRAPH POLES

Two Great Corporations Very Desirous of Discovering a Means to Effect a Large Economy

FOR the last two years the Bureau of Forestry has been co-operating with the American Telephone and Telegraph Company and recently with the Postal Telegraph-Cable Company also, in an experimental study to increase the durability of telegraph and telephone poles. The interest in this matter taken by these corporations promises an important forest economy through the possibility of using much smaller trees than are now cut for poles. This means a new market for these smaller trees and liberating the larger ones for other uses.

The length of service of a telegraph or telephone pole is determined in a section of the pole not more than a foot or a foot and a half long. In a standing pole this section extends about six or eight inches above and below the top of the ground. This is the universal point of attack upon the life of the pole, and is called its breaking point. Decay is the arch-enemy of these poles. It sets in at the ground line and reaches both up and down the

pole, but only so far as the conditions exist which promote the growth of wood-destroying fungi. A few inches below the ground there is lack of the necessary oxygen and heat, while at about the same distance above ground the requisite moisture fails. The exact time at which decay begins its work depends upon the climate, the character of the soil, and similar conditions. In a hot, moist climate it ordinarily sets in with great rapidity. But at best, in a very few years after the pole is set the struggle has commenced. The decay soon girdles the pole and gradually eats into it deeper and deeper until it is so weakened that it breaks under the weight of its equipment.

The strain upon the pole from wind pressure and the weight of its cross-arms and wires is calculated for the ground line. When the diameter of this ground line is constantly decreased, the strength of the pole is proportionately reduced, and it becomes only a question of time when the pole

must fall. Chestnut and white cedar have been found, among available woods, most successfully to resist decay; but the life of the former is only from twelve to fifteen years, and of the latter ten to twelve years. The co-operative study of the Bureau is for the purpose of extending, if possible, this time.

The experiments already made by the Bureau show conclusively that poles can be subjected to a preservative treatment which insures materially lengthened service. This treatment consists in impregnating the wood with antiseptics which prevent the growth of the fungi that cause decay. The treatment of telegraph and telephone poles, when attempted at all in this country, generally has been applied to the whole pole, requiring the use of air-tight cylinders 100 feet long or more. In these the poles are subjected to live steam for some time, when a vacuum is created. Creosote is then run in and pressure applied to force it into the wood. Manifestly this is a laborious process. Yet for telegraph and telephone poles only about one foot of the entire length needs to be made immune from fungus. If this foot at the fatal ground line can be preserved from decay, the rest of the pole will take care of itself. Experiments will now be made in treating the butts of the poles for a distance of about eight feet, thus carrying the antiseptics just beyond the zone of decay attack. The creosote method will be used and dead oil of coal tar forced through the butt of the pole.

The telegraph companies have made little use of preservative treatment. They employ millions of poles on their various lines, and it would be a tre-

mendous economy to add even a few years of service to the life of each pole. But there will be another large saving both to them and to the forests through preservative treatment. To provide a good margin against decay, poles are now much larger than demanded by the strain upon them. It is expected that decay will quickly eat away a furrow around the pole at the ground line, and the diameter of the pole at that point is gauged to allow for this weakening process. When it is known that decay, in a certain number of years, cuts the diameter from perhaps twelve to eight inches, and that below eight inches the weakened pole falls, the course to be pursued is obvious. Antiseptics prevent, for the time of their effectiveness, the starting of decay, and thus permit at the outset the selection of an eight-inch diameter rather than a twelve-inch. The four inches saved represent a tremendous difference in the size and age of trees used for poles. Both the companies and the owners of forests will be great gainers by this economy, with its shortening of the length of time necessary to grow a pole.

Another feature of the co-operative work will be treatment of cross-arms. The companies have been treating them, but report too much absorption in some cases and not enough in others. The Bureau will more carefully grade the different kinds of wood, and treat each class separately. In this way it is expected to secure a more equal absorption and more satisfactory results. These are the main points covered by the contracts, though in addition the Bureau will furnish information on the supply of pole timber and such general advice as may be suggested by the co-operative work.



A PORTO RICO FOREST RESERVE

Characteristic Tropical Forest and the Uses to Which it Can be Put

THAT one of our national forest reserves is in Porto Rico is a fact of which very few people in the United States are aware. Yet both in the extraordinary variety of botanical species which its forests contain and in the picturesqueness and novelty of its scenery this reserve stands second to none of those in our western states, while it has the unique distinction of being the only tropical forest which this country owns on this side of the globe.

The Luquillo reserve was set aside by Presidential proclamation in January, 1903. It embraces some 65,950 acres of land in the eastern and most mountainous part of the island. Compared with most of the western reserves this is small. But the whole island of Porto Rico is only about three-quarters the size of Connecticut and consequently offers no room for a large reserve.

Teh Luquillo reserve was set aside from certain public lands in Porto Rico which were formerly the property of the Spanish government. It is joined by private holdings and also to some extent by lands the title to which is now vested in the insular government, which is possessed of all lands not reserved by the federal government before June 30, 1903. The whole region within which the reserve lies has never been surveyed or accurately mapped, and the boundaries between the private and public holdings are very vague and undefined. In practice the agriculturists to whom the private lands belong have pushed their clearings as far up the mountain sides as it was profitable for them to go, and have helped themselves more or less to whatever timber they needed from the accessible forest beyond. These depredations have not been, on the whole,

very serious, owing to the tropical character of the forest and the difficulties of transportation, but the exact definition of the line between the reserve and the adjoining private owners is a pressing need.

To secure information concerning present conditions and a basis for recommendations to the insular government for a future policy, Dr. John C. Gifford was sent by the Bureau of Forestry, in the summer of 1903, to make an examination of the reserve. He found that only about 20,000 acres are forest lands unclaimed by private owners, and half of this is in mountain peaks and palm lands, so that there are only 10,000 acres of productive timber. Nevertheless, the whole reserve stands in an important relation to the economic welfare of the people who live near it, and the benefits of its establishment will be increasingly manifest as time goes on.

Even to the natives the region embraced in the reserve is little known. It is a small wilderness of serrated mountains, tropical forest, and rushing torrential streams, concerning which all sorts of fantastic fables find currency. It covers a large part of the Sierra de Luquillo, a mountain mass separated from the mountains of the rest of the island by the valley of the Loiza, the largest river in Porto Rico. One of its peaks, El Yunque, is the highest mountain of the island, with an altitude of some 3,300 feet. Upon the eastern slopes of these mountains, which face the sea, the westward-blowing trade winds pour an enormous precipitation, the heaviest in the island. In 1902 the total was almost 142 inches. This rainfall is well distributed throughout the year. In the highest mountains it is rare for twelve hours to pass without some rain. As

a rule heavy, drenching shows alternate with bright sunshine. The result is violent fluctuations in the streams, which often leap into impassable floods and subside again within an hour or two.

It is as an agency for the control of these flood waters that the Luquillo reserve is likely to render the most valuable service. To some extent the forest will even supply water for agriculture, for immediately to the south and west of the mountains the climatic conditions become very different from those on the always profusely watered eastern slopes. The country is drier, evaporation more active, and the vegetation correspondingly changes its character. So while parts of the island are drenched with water most of the time, other parts, half a day's ride distant, are dependent upon irrigation. But generally it is against too much water rather than the want of it that the protection of the forest is needed. Even with the mountains forest-covered, floods have caused great destruction. Massive stone bridges have been carried away, roads damaged, farms and pastures ruined, and lives lost. Stripped of their forests, the mountains would soon be washed bare of soil and the lowlands swept by floods after every heavy shower.

What the value of the reserve will be as a source of timber supply is more or less problematical. Mahogany, if ever present in the forest, as seems probable, has been entirely exterminated, and the cigar-box cedar is also practically gone. Valuable woods remain, but the essentially tropical character of the forest, in which a great number of species contend with one another for possession, makes the problem of management a very difficult one. "Weed trees" abound, and there is no uniformity of forest growth. Individuals of the same species occur scattered sparsely and irregularly through the dense forest, and it is an extraordinary fact that within so narrow a range as the island affords certain kinds which in some places

grow to be large and beautiful timber trees elsewhere exist as shrubs.

The best of the forest in the reserve is that found in the fertile gorges, ravines, and covers from 500 to 2,000 feet above sea level, where the trees are protected from the constant winds. There are four leading timber trees—the tabanuco, with a wood very like our sycamore; the laurel sabino, which would grade in the market with yellow poplar; the ausubo, comparable with the black walnut, and the guaraguao, similar to red cedar. All these trees reach a large size, ranging from two to five feet in diameter. The tabanuco has, in addition, the very valuable characteristic that it tends to form pure or nearly pure stands. It produces a kind of gum which may prove to be an article of commercial importance.

Many climbing vines add to the density of the vegetation. There is also a species of grass which grows five feet high and cuts like a razor at the lightest touch. But the most abundant growth is that of the mountain palms. They are very beautiful, but of little or no value, and to get rid of them will be at once a necessary and most difficult matter if permanent production of salable timber is to be secured. They grow forty feet high, and already cover fully half of the best part of the reserve. Yielding as they do an immense amount of seed, and growing very thickly, nothing else in the forest can compete with them for possession on anything like equal terms, so that unless they can be artificially held in check they will certainly gain most of the ground left vacant by the removal of trees cut for timber. They are true weed trees of the most aggressive kind.

Above two thousand feet altitude the trees are stunted, gnarled, and slow-growing, of many different species, with moss-covered limbs and roots often bare. They are of no commercial value, but are of great importance as a protective forest cover.

Doctor Gifford believes that the Luquillo reserve should be cared for and

developed along two distinct lines. From an economic point of view it should be managed to secure the best returns from the sale of timber and other forest products, consistent with the maximum protection of the watersheds. It should also be made acces-

sible to the public for its scenic attractions. Roads should be opened and fish and game introduced. At the same time from a scientific standpoint the extraordinary interest of its undescribed flora opens a splendid opportunity for studies of tropical forest botany

FORESTRY AND THE RAILROADS

Wooden Tie-Plates are Successfully Being Used Under Advice from the Bureau of Forestry

UPON the advice of the Bureau of Forestry, the Gulf, Colorado and Santa Fé Railroad eight months ago began to experiment with wooden tie-plates. These plates are intended to protect the tie from wear under the rail. They are cut the width of the bottom of the rail and as long as the tie is wide—usually six or seven inches—and are kept in place by the weight of rail, in a flat groove in the tie. The results of the experiment are of much interest both to the railroads of the country and to those who have at heart the cause of forest protection.

The Santa Fé placed cypress tie-plates one-quarter of an inch thick on several thousand old and much-worn cypress ties laid in its track north of Galveston, Tex. After eight months of constant use the plates are perfectly sound and show practically not a trace of wear. The officials of the road are greatly pleased with the result of this trial.

The Bureau of Forestry will now make similar experiments with red gum, red oak, and beech tie-plates, which will be placed in the tracks of the St. Louis and San Francisco, the Burlington, and the Northern Pacific systems. These are all harder woods than cypress, and are therefore less liable to wear under the rails, but are much more subject to decay. The tie-plates made from these woods will therefore all be heavily creosoted. This will make them about as resist-

ant to decay as the untreated cypress, while their much greater hardness will better qualify them to resist the wear of the rails.

For a number of years cross-ties have been treated with preservatives, and tie-plates of iron have been used to increase their length of service. Tests are constantly being made by the Bureau of Forestry to improve the character of the preservatives and the methods of their application, and to enlarge the number of woods used for railroad construction purposes. Experimenting with wooden tie-plates is work along the same economical line, in the interest of both the railroads and the forests. The use of a tie-plate prevents wear on the tie and adds years to its service; wooden tie-plates are being successfully substituted for the more expensive iron, and abundant and cheaper woods, through preservative treatment, are becoming available to take the place of scarce and expensive woods. When a wooden tie-plate is worn out a new one can be quickly and cheaply inserted in its place. In Europe these plates cost but \$2 a thousand, or \$2 for every 500 ties, since two are used upon each tie. Preservative treatment keeps the tie from decaying, the wooden tie-plate keeps it from wearing, and the use of both will result in a huge economy for the railroads, which will react favorably upon our forests.

COLORADO PRACTICING FORESTRY

The State to Create a Separate Department to Control its Forest and Help Build Up its Industries

TWO political platforms in Colorado contain a declaration favoring the creation of a state department of forestry. This, if carried into effect by the legislature, will notably benefit both the state and forestry, since the general welfare of Colorado is peculiarly dependent upon the rigid care and protection of its forests. Almost one-third of the total area of that state, or 33,500 square miles, is woodland, of which about 20,000 square miles are covered with valuable timber. This is chiefly pine, although cedar, hemlock, spruce, fir, and other species are also found in merchantable size and quantity. But the greatest value of the Colorado forests is in their promotion of agriculture through irrigation. Already there are nearly 2,000,000 acres of farm lands under irrigation, but great stretches of country are still to be redeemed. This cannot be done unless the watersheds of the state in the mountains and hills are rigorously kept under forest cover.

The grazing and lumber industries, as now conducted, and the ravages of fires are against the forests. The lumbering and still more the grazing interests of the state are too valuable not to receive careful consideration. Each, and more particularly the latter, must be carefully and judiciously regulated with two ends in view—their own welfare and continuation, and the protection of the forests. As for fire, it is the same deadly enemy in Colorado as in other large forested areas, and restraining regulations must be enacted and enforced.

Forest preservation is a vast economic question intimately interwoven with many other matters of vital state concern, but it is a question with a distinct field of research and demands specialized inquiry, enactment, and jurisdiction. Hence the necessity for the

creation of a state department of forestry. Through it all local work can most effectively be done, and it also furnishes an agency through which the state may come into closer touch with the National Bureau of Forestry and thus secure advice based on a wide range of investigation.

The federal government has put something over 3,000,000 acres of the public land on the watersheds under forest reserve. In addition, agents of the Bureau of Forestry have, within the past two years, made careful studies of both these reserves and other public forests of the state, to the end that the federal forest reserves may accomplish the greatest possible good. But 3,000,000 acres are a small part of the 21,440,000 acres of woodland in Colorado. All the remaining 18,000,000 or more acres are to a greater or less extent important in conserving the irrigation and farming future of the state. It is, therefore, fortunate that Colorado seems likely to handle its forests in this practical way, the only way by which the best results can be accomplished.

Such action will increase to twelve the number of states which have created separate departments of forestry. Yearly and daily the importance of understanding and guarding the forest, which stands in close relations to many and varied industries, is growing. Each state which adds the weight of its official action gives new impetus to the movement which aims to secure the largest usefulness of our forests in the interest of the public welfare. Other states, particularly those whose forests are among their greatest resources, could do nothing more practically beneficial to their future than quickly to follow the policy now demanded by the people of Colorado.

USE OF THE GRAIN DRILL IN IRRIGATION DISTRICTS

BY

HERBERT M. THOMAS

IF THERE is one agricultural implement of the humid east which is eminently adapted to the irrigation farmer, it is the grain drill, and it is perhaps the least used of all the ordinary implements of the farm, for over the greater part of the irrigated west, grain is either broadcasted by machinery or by hand, and harrowed into the soil.

Irrigated soil has the faculty of baking on the surface, in many districts, and it is a peculiar fact that such soils are the ones in which the grain is broadcasted and where the first irrigation so bakes the surface that the tender little plants have a struggle for life. This can largely be avoided by different methods of procedure. In Utah, where the small farmer is the rule and where the average farm in certain counties is about 25 acres, the grain drill is in use, and there is never heard the statement that the drill is "too slow." In California, where the grain farms are large, seed is either broadcasted or sowed just behind the plow by a contrivance which resembles in its operation the grain drill.

The method of grain land management, which seems most successful in soils which bake, is something like the following: The land is irrigated and plowed; if it seems too dry for the seeding of grain, a second irrigation is then given it, and when the amount of moisture is just right, grain is sowed with the drill. The seeds are deposited in a moist soil and the drill leaves the surface in a cultivated condition so that the top crust cannot form to choke down the seedlings. Germination results promptly, and the little plants find themselves in the

proper depth of soil with the roots in moist, compacted material in capillary contact with the subsoil, while a mel-low surface does not hamper the development of stem or leaves, and before the soil's store of moisture is depleted the plants are so far developed that the next irrigation does no harm, and the shade produced prevents the baking of the surface of the ground.

On the other hand, the customary method is something like the following: The land is plowed (sometimes), harrowed (sometimes), and grain is sowed by a broadcaster; a harrow or drag then goes over the surface, leaving part of the seed for the birds, another part in shallow soil, and none of it in the most favorable condition for the sturdy growth so necessary in a young plant. The majority of the germinating seeds find it necessary to send the rootlets down an inch or two through half-dried soil to find moisture, while the leaves pushing upward have a like amount of dry material to penetrate before air and sunshine can be reached. Plants struggling along under such conditions have a weakness bred in them from the start, and in the growth which follows are not so well enabled to resist the difficulties which may beset them.

Farming under irrigation is fast losing the extensive character so characteristic of American agriculture, and taking on the intensive character which means getting all out of the soil there is in it. The grain drill is one important instrument in this progress. Irrigation is developing many new tools, but there is none so well adapted to the needs of the irrigation farmer as the grain drill.

THE SAFE-GUARD OF THE RECLAMATION FUND

BY

F. H. NEWELL

Chief Engineer U. S. Reclamation Service.

MANY of the people in the East have only vague ideas as to the practical workings of the Reclamation Law. With not a few the belief seems to be that the Government is engaged upon a purely philanthropic work of constructing large and costly irrigation systems, and after completion generously donates these works to the farmers. While Uncle Sam is certainly evincing an exceedingly fatherly interest in his children who dwell in the desert, his generosity does not extend quite to this point.

The manner in which the return of any funds expended on irrigation is safeguarded will strike most everyone as being similar to the methods observed by business institutions which make a practice of loaning money.

When the investigation of an irrigation project is developed to such an extent that there is little doubt of its feasibility, it becomes necessary to provide for an association of water users. This is essential because it would be otherwise impossible to work out satisfactorily the various matters in which the interests of the Government and of the individuals are involved.

One of the important matters to be adjusted by these water users' associations is the protection of the Government in its expenditures. The law provides that the water users shall return to the reclamation fund the cost of the construction of the works. There can be no assurance of the return of such moneys unless security of some kind is provided. This interest of the government is protected through the water users' association by a provision in its articles which makes all assessments on water rights,

including the charges by the Government, a lien on the land of the shareholder.

Furthermore, the water users' association as such makes a contract with the Secretary of the Interior in which it guarantees the payment of the charges assessed against the lands of its shareholders. This agreement, before being executed on the part of the corporation, is voted upon by the shareholders, and a two-thirds vote is necessary to ratify it.

The shareholder and the water users' association, through their articles of incorporation, make a contract by which the land of the shareholder is pledged for the payment of necessary charges; and in addition to this the association guarantees to the Government that it will pay these charges and exercise the lien authorized by its articles in order to secure such payment. The matter is in this way left in the hands of the people themselves, and in case a shareholder should, through sickness or other unavoidable misfortune, be unable for a year or two to pay his assessments, the association can advance the money to carry him over his period of misfortune. In cases where the delinquent is not deserving of such consideration, his own neighbors, knowing the exact situation, will be in a position to enforce the conditions of the articles of the association and sell such part of his land as may be necessary to cover the charges for the water right.

These charges are a lien on the land only to the extent of a particular assessment from year to year, and in case of a delinquency the entire charge for the water right does not become

due and chargeable against the land as in the case of an ordinary mortgage when default is made on a part payment. This is not necessary under the conditions of a reclamation project, because the land itself is of such great value that there is no difficulty in obtaining settlers to take up the land which an individual is compelled to relinquish.

The whole theory of the water users' association is to provide for self-government among those who use the water and pay for the irrigation system. The law provides that they shall ultimately manage and maintain the

system at their own expense, and the policy of the Reclamation Service is to put into their hands an increasingly greater share of the management, in order to gradually educate them up to the point of controlling in the proper manner an enterprise of such great magnitude. The law provides that the ownership of the system and a supervisory control shall always be maintained by the United States, in this manner affording ample assurance to each individual that the rights which he has acquired from the United States shall always be fully protected.

IOWA PARK AND FORESTRY ASSOCIATION

The Fourth Annual Meeting Successful
and Shows Much Interest in the State

THE fourth annual meeting of the Iowa Park and Forestry Association was the most successful that this organization has yet held. The following officers were elected for 1905: President, L. H. Pammel, of Ames; vice-president, Wesley Greene, of Davenport; secretary, Prof. Thomas H. Macbride, of Iowa City; treasurer, J. C. Monnett, of Iowa City; executive committee, J. S. Trigg, of Des Moines; H. P. Baker, of Ames, and C. A. Mosier, of Des Moines; legislative committee, C. L. Watrous, of Des Moines; B. Shimek, of Iowa City; Sidney Foster, of Des Moines; Bruce Fink, of Grinnell, and Elmer Reeves, of Waverly; committee on ways and means, Wesley Greene, W. A. Burnap, of Clear Lake; Eugene Secor, of Forest City; committee on civic improvements, A. T. Erwin, of Ames; Silas Wilson, of Atlantic, and B. Shimek.

Dr. Bruce Fink, of Grinnell, delivered an interesting address on the proper methods for tree pruning, pointing out common errors commit-

ted and suggesting the best methods to follow. "Forestry in Northwestern Iowa" was ably discussed by Ellison Orr, of Waukon.

Prof. T. H. Macbride made a plea for the preservation of the old historic landmarks like Camp McClellan and other historic spots in Iowa that are dear to the memory of the pioneers.

The secretary of the association, Prof. L. H. Pammel, reported on what the college has done in planting, both for park and forestry purposes, during the last thirty years, giving a list of the hardy trees like the white pine, white spruce, red elm, Austrian pine, elm, Norway spruce, hemlock, hard maple, soft maple, red cedar, and cottonwood, giving accounts of their hardiness and adaptability to different conditions.

Professor Shimek, of Iowa City, on "Reforestation in Iowa" said: "Each one of more than half the counties of Iowa contains rough lands, conservatively estimated at 10 to 50 square miles in total area, which lie chiefly

along the larger streams. These counties are mostly in the southern and eastern parts of the state, but include those also cut by the Des Moines and its larger tributaries, and some of those which lie along the Missouri." The lands in question are not suitable for cultivation. He advised township and county parks, to take better care of private property, and that our public schools should disseminate information which is desirable along the line of forestry.

In his report on "Civic Improvement and Municipal Legislation," Prof. A. T. Erwin reported that the destruction of trees by telephone companies had multiplied. Rural telephones and suburban car lines had increased, and the question of the protection of trees is more important than ever before. In many cases the roadway is entirely too narrow. A tree with a good clean trunk is highly desirable; such a tree is the white elm; it adapts itself more to these unfavor-

able conditions than many others. The Iowa law, if enforced, is regarded as ample to protect the trees. Mr. J. C. Monnett presented a long and valuable paper on the legal phases of tree protection by property owners in various parts of the United States.

Papers were also read by Dr. J. E. Cathell, who eloquently pleaded for the beautifying of our cities and for forest reserves to develop the goodness and greatness of man. Dr. A. B. Storms likewise pleaded for a greater civic pride and enthusiasm in our cities, citing as an illustration the notable work accomplished by the late Colonel Waring, of New York, and the enthusiastic civic movement in many cities. Professor Ashbaugh made a strong plea for the preservation of certain lakes for forestry and park purposes in the state. Doctor Mogridge discussed the subject of school gardens as a tendency to a better knowledge of agricultural and horticultural problems of to-day.

THE BELLE FOURCHE PROJECT

THE principal work of the Reclamation Service in South Dakota this year will be on the Belle Fourche project. In this State attention has been given only to reclamation projects west of Missouri River, and especially to those in the vicinity of the Black Hills. Any reclamation of lands on any of the streams of this region must be founded on storage of storm water and spring flow.

The Belle Fourche River rises in east-central Wyoming and flows northeast, then east, draining the western and northern portions of the Black Hills. This project involves the reclamation of lands lying northeast of the Black Hills, in Butte and Meade counties, South Dakota, by the diversion of the waters of the Belle Fourche and Red Water rivers into a large basin east of the town of Belle Fourche, South Dakota. This basin

is to be converted into a storage reservoir by the construction of an embankment of earth, ripped with rock, across Owl Creek.

The reservoir will be filled by a large feeder canal from the river, 6 1-2 miles long, 40 feet wide on the bottom, and capable of carrying 10 feet depth of water. Additional water will be obtained from Crow, Owl, Indian, Horse and Willow creeks, which have a large flood flow during limited periods. From the reservoir, which will have sufficient capacity to impound water for all the lands to be irrigated, the water will be distributed to lands in the valley on both sides of the Belle Fourche River, where 80,000 acres of land may be reclaimed. The land was segregated July 18, 1903. The segregation comprises 465,600 acres.

A reconnaissance of the project was made from June 22 to 25, 1903, by Mr.

R. F. Walter, district engineer, and gaging stations were established on Belle Fourche and Red Water rivers, by which the daily run-off is determined. Surveys were ordered in July, 1903, by Mr. C. H. Fitch, supervising engineer, and a preliminary survey was made of the canal line to Owl Creek reservoir. The north outlet canal from the reservoir was run to Willow Creek, and a high-line canal to Dry Creek No. 2. In all 115 miles of canal line were located before work had to be abandoned for the winter.

The two sites known as Dry Creek and Wilson reservoirs were mapped on a scale of 1,000 feet to the inch, with 5-foot contour intervals. A reservoir area of 5,700 acres was thus covered. The Survey also took up topographic mapping on a scale of 1:45,000, with 20-foot contour intervals. An area of about 75 square miles was thus mapped.

In April, 1904, a reconnaissance survey was made to determine the possibility of obtaining an increased water supply from the Little Missouri River and of storing the water thus obtained. It was found that such a plan was entirely practicable.

At present work on the project is well advanced. Preliminary surveys on inlet canal (to feed the storage basins), on north outlet canal, and on the proposed Dry Creek and Wilson reservoir sites were completed in 1903.

During the past summer the south side canal, which will water lands on the south side of the Belle River in the vicinity of Vale and Empire, was surveyed and mapped on a scale of 200 feet to the inch.

The survey of the extension of the north side canal from the point where work was stopped in November, 1903, was resumed and the line was extended to the Elm Creeks. A large body of vacant land is located here which may be brought under the project if the private land owners under the south side canal fail to subscribe for water and the canal is not built.

The Owl Creek reservoir site has been surveyed and has been mapped

on a scale of 1,000 feet to the inch, with 5-foot contour intervals. This is an extension of the Dry Creek reservoir site, obtained by the change of the location of the dam to a point across Owl Creek just below the mouth of Dry Creek. The capacity is more than double that of the first site contemplated, but the cost is much less than double.

The mapping of the Alzada reservoir site on the scale of 1,000 feet to the inch with 5-foot contour intervals, has also been completed and estimates have been made. The feeder canal for the reservoir from the Little Missouri River has been surveyed, either to be used as a diversion of this stream to the Belle Fourche or as an independent project.

The irigable lands have been mapped on a scale of 1,000 feet to the inch, with 5-foot contour intervals. About 200 square miles have thus been mapped on both sides of the river above the Willow Creek divide.

Detail sheets have been completed of the main diversion dam site, Owl Creek dam site, south side canal diversion dam site, and the Indian and Crow Creek crossings. These sheets are on a scale of 200 feet to the inch, with 2-foot contour intervals.

Borings have been made at all dam sites and creek crossings for the purpose of obtaining information as to foundations. They have also been made at points from 500 to 1,000 feet apart along the canals for the purpose of classifying the material to be moved.

The organization of the private land owners has secured subscriptions for about three-fourths of the private land under the whole project, or four-fifths of the private land on the north side.

The available water supply has been estimated, and plans for all permanent structures have been drawn.

A reconnaissance was made in June, 1904, of the headwaters of the Belle Fourche River for suitable sites for further storage, but no feasible sites were found.

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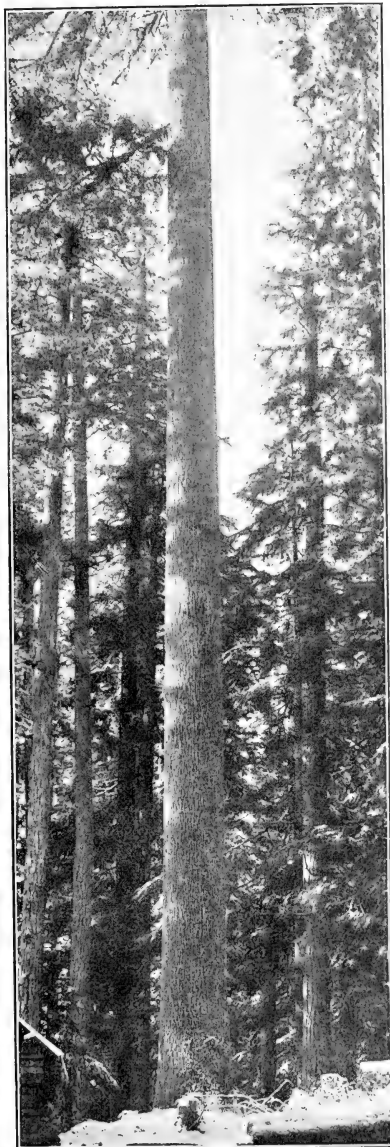
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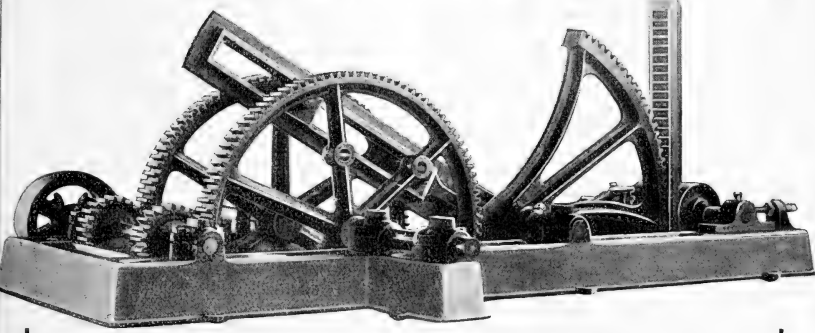
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2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.
3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.
4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.
5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.
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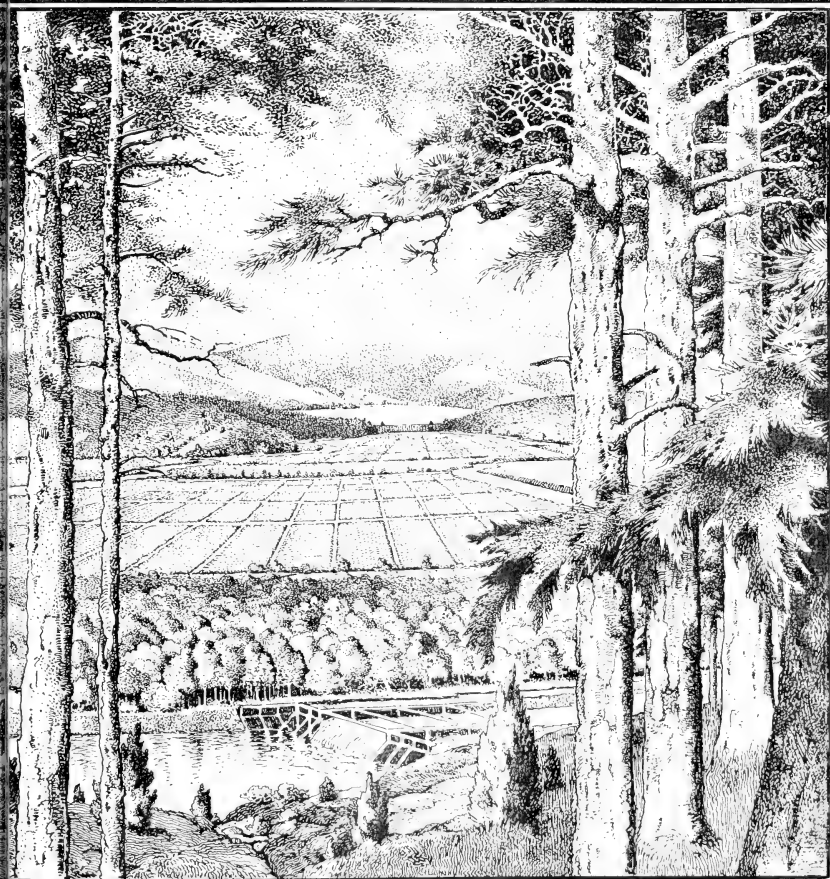
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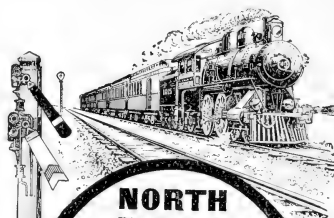
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The objects of this Association are to promote :

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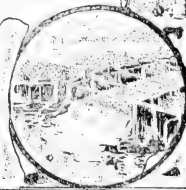
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Virgin Forest Scene in Oregon.

NEWS AND NOTES

Transfer of the Reserves.

At last the transfer of the forest reserves from the Department of the Interior to the Department of Agriculture is an accomplished fact. The bill for this purpose passed Congress the last week in January, and was signed by President Roosevelt on February 1st. From now on the administration of the reserves, as outlined in an article elsewhere in this number of *FORESTRY AND IRRIGATION*, will be directly under the control of the Bureau of Forestry.

This transfer of the administration of the forest reserves has come after many vexatious delays. For four years the friends of forestry have stood together to bring about this result. The American Forestry Association was a potent factor in the creation of the reserves, and the first laws for their administration, and it has likewise been a powerful ally in the move for the consolidation of all forest work. With the active management of the reserves in the hands of Mr. Gifford Pinchot, who has fought so tenaciously during the past four years to bring about the transfer, we may look for a sensible, business-like handling of the public forest lands. This victory in securing the transfer of the forest reserves in the face of much selfish opposition is one of great consequence, and reflects the greatest credit on the movement headed by Mr. Pinchot. It should encourage all friends of conservative forest management to keep hard at work for the numerous projects of like nature which should be carried through at an early date.

Proceedings of the Forest Congress.

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papers delivered at the Congress, the resolutions passed, and list of the delegates who attended. Altogether it will make the most comprehensive and authoritative volume on forestry that has yet been issued in the United States. The publication of the proceedings will be handled for the Association by the H. M. Suter Publishing Company, of Washington, who are the publishers of this magazine. The price of the volume will be \$1.25, postpaid. Persons desiring copies of the proceedings should send in their orders at once, accompanied by check or money order for the amount.

To Inspect Arid West.

The Senate and House Committees on Irrigation have arranged for a trip through the entire arid West next June and July, starting at Omaha and going first to Nevada, where, on June 17th, the third anniversary of the approval of the reclamation act, they will witness the formal completion of the Truckee irrigation project. This will be the first project to be completed under the reclamation act.

The members of the committee will then go to New Mexico and Arizona, taking in various projects in both territories. They will make a personal inspection from Yuma of the Colorado river valley, including the Imperial country, in order to become familiar with what has proved to be a perplexing problem in irrigation development.

The committees will then make a tour of Southern California, inspecting irrigation plants and will be entertained at Los Angeles, going thence to San Francisco. Meetings will be held for the purpose of gathering information regarding the big Sacramento valley project, which is declared by officials of the reclamation service to be the largest project in the United States. Visits will be made to various places in the Sacramento valley, and thence to Oregon, Washing-

ton, Montana, Idaho, Wyoming and Colorado. The Senators on the Irrigation Committee who are expected to make this trip are: Warren, Hansbrough, Ankeny, Fulton, Bailey, Patterson, Gorman, and Newlands. The members of the House Committee are: Mondell, Reeder, Tyrrell, Dwight, Marshall, Cooper, Williamson, Underwood, Hitchcock, and Van Duser.

Working for Porto Rico's Forests.

Efforts are being made by the citizens of Porto Rico to secure legislation looking to the preservation of the forests of that territory. The establishment of the Luquillo Forest Reserve in Porto Rico has brought to public attention the vast benefits that come from proper forest conservation and protection, and has impelled some of Porto Rico's most prominent citizens to lend their aid to the forest movement, and endeavor to secure legislation during the present session of the Porto Rico Legislature. Porto Rico possesses the only distinctly tropical forest that is a part of the United States in this hemisphere, and legislation looking to an administration of its forest wealth on the principles of practical forestry should have the support of all public-minded citizens.

Forest Reserves in 1904.

In 1904 seven new forest reserves were created—Baker City, in Oregon; Cave Hills and Slim Buttes, in South Dakota; Grantsville and Salt Lake, in Utah, and Warner Mountains and Modoc, in California. Additions were made to the Fish Lake (Utah), the South Platte (Colorado), and the Big Horn (Wyoming) reserves. These reserves cover in the aggregate 893,136 acres. A total area of 310,241 acres were added to existing reserves, but 923,782 acres, which examination had shown to be better suited for agriculture than for forestry were restored to the public domain, so that the net increase in the area of the reserves was but 149,035 acres.

New Experiments in Turpentine.

The old system of boxing Southern pine trees for the production of turpentine and rosin has very greatly reduced the pine timber wealth of the Southern States. Three years ago the Bureau of Forestry determined that something should be done to eliminate so destructive a method of procuring naval stores. Its three years' experiments towards this end, just completed, have demonstrated that a new system of turpentineing, which requires the use of earthen cups and metal gutters, not only greatly conserves the life of the timber tapped, but gives an increased yield of rosin, and therefore a greater profit than is possible by boxing. The box method and the new cup and gutter system of turpentineing are fully described and illustrated in Bulletin No. 40, issued by the Bureau of Forestry.

While the new system is not yet in use by all turpentine operators, its application is extending as rapidly as the necessary equipment can be secured. At present there is but one company supplying the kind of cups and gutter iron required. It is hoped, since the demand for this material is very great, that in the near future the supply will be sufficiently increased to enable turpentine operators to procure the needed equipment.

While, in the work just completed, the Bureau of Forestry has performed an important service to the turpentine industry, it feels, nevertheless, that a still more conservative method of turpentineing can be found, particularly one which, consistent with a maximum yield of turpentine, shall inflict the smallest possible injury upon the trees. With this in view the Bureau has begun an entirely new line of field experiments, in order to determine to what extent the wound now made in tapping the trees can be lessened.

Through the generosity and cordial coöperation of the Hillman Suthern Land Company, of Jacksonville, Fla., a stand of about 40,000 pine trees in Clay county, Florida, together with

other facilities, have, without cost to the Government, been placed at the disposal of the Bureau for experimental purposes.

The principal experiments now set on foot, comprise the practical working of a number of different turpentine crops. One set of trees will be used to determine, within practical limits, the best width of face to be cut on trees of different diameters.

Another set of trees will demonstrate, with approximate exactness, the rate in height, per streak, at which weekly chippings should proceed, in order to stimulate a full flow of rosin. It is believed that the weekly chipping now practiced cuts away in height, at one time, too much of the living wood; in other words, the face of the tree is increased too rapidly upwards. At present this upward chipping amounts to about 18 inches every year, and it is thought that this can be reduced at least one-half or two-thirds. Such a saving in face height will permit a considerable increase in the number of crop years, which, in turn, should give a much increased total yield of rosin as well as reduce the demand upon the area of pine forests. There will also be an economy for operators in having to move their equipment from one set of trees to another less frequently than is the case at present.

Still another set of trees will be devoted to finding out how deep toward the center of the tree each streak should be chipped. Under the present practice, it is believed that an unnecessarily deep cut is made, thereby greatly reducing the vitality of the tree and consequently its capacity to produce rosin continuously.

Blueberry Culture and Forest Fires.

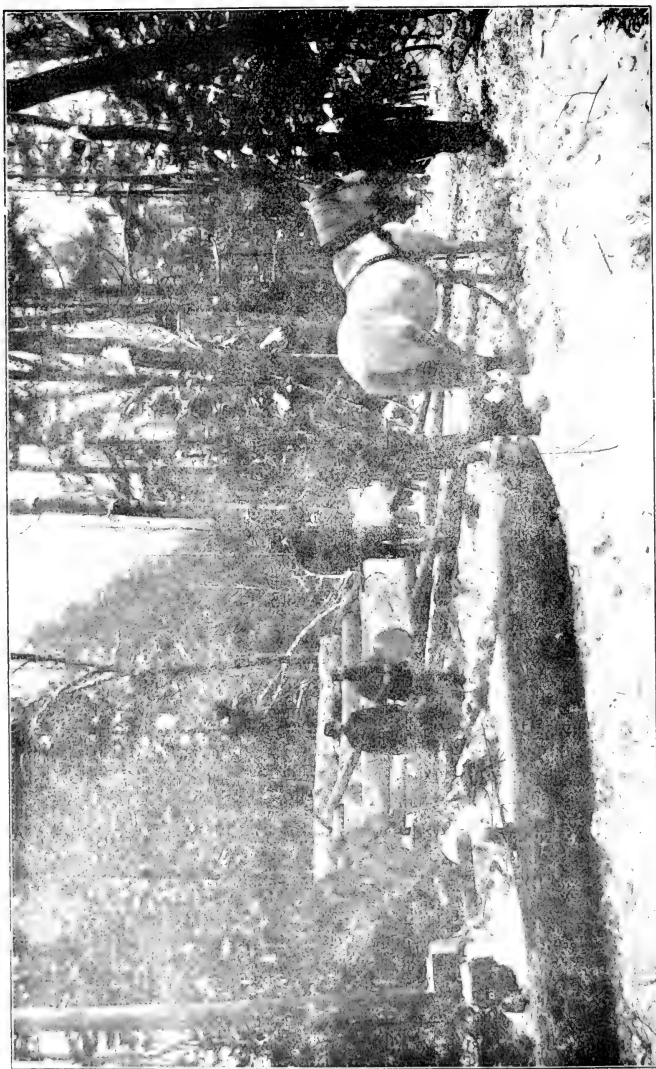
In grazing sections throughout the West an old and well known custom is that of burning the dry grass to improve the next year's pasture. Formerly the fires were allowed to spread and burn themselves out at will, and the practice resulted in great forest destruction. Happily for the forests, the burning is now more carefully

done when it is done at all, and on the whole the custom is falling into disuse. In Maine a practice of burning exists which is local to that State, is novel in character, and has nothing to do with grazing. The burning is to assist blueberry culture by causing the bushes to sprout vigorously and clearing the ground of other growth.

About 1870 a factory for canning blueberries was located in Maine, and as it prospered it was followed by others. In 1885 and again in 1899 similar factories and canning companies were established, until to-day blueberry raising and canning is an important industry in that State. To supply the increasing demand blueberry bush areas have been constantly enlarged, until now "blueberry barrens" cover some 2,600 acres in Hancock and Washington counties.

A century ago these "blueberry barrens" were for the most part covered by a dense forest, chiefly of white pine and spruce. The forest was thinned by lumbering the pine, and the increased amount of light permitted new kinds of undergrowth to get a foothold. Fire, as almost invariably happens, followed the lumbering, the rest of the original stand was destroyed, and the undergrowth was still further altered, a great variety of valueless underbrush and weeds taking possession of the ground, together with a stand of birch, popple, red maple, and other hardwood seedlings. As the fires continued to occur this hardwood growth changed to a very scrubby character and was finally entirely eliminated, and the ground became a true barren, covered with a growth of blueberry bushes, sweet fern, brake, bunchberry, goldenrod, and sheep laurel. With the ground in such condition its best use is for blueberry culture.

The blueberry owner divides his land into three portions; each year he picks the berries from one portion, burns another portion, and allows the third to rest. The first year after the land is burned over the blueberry



Skidding Logs in an Adirondack Forest in Winter.

bushes sprout and grow a few inches. The second year they yield a full crop of berries. The third season the crop is small and of little value, and the bushes reach a condition in which they can be burned most effectively.

Under this system of blueberry culture the land does not "run out" with constant use for the same crop. Where the burning has been properly done the same tracts have grown blueberries continuously for 50 years without showing any decrease in the yield. But if the land is burned over at the wrong time of the year, or the roots of the bushes are badly injured by fire, many years are required to restore the productive capacity of the tract. The best time for burning is when the melting snow leaves the ground wet and the tops of bushes dry. After May 10th burning is very injurious, unless the spring is exceptionally late.

The canning companies own most of the blueberry lands in Maine, except some small 25 or 30-acre private holdings. Pickers from company lands get 3 cents a quart, while private owners receive about 6 to 8 cents a quart for their berries. The picking season lasts six weeks. A rapid picker makes from \$4 to \$8 a day; if he has a large family to help him it is not unusual for him to make \$600 or \$800 in the six weeks. This makes the industry very popular among the pickers, and increases the danger that forest fires will be set or permitted to burn through good timber in order to increase the extent of blueberry barrens.

In addition to the 2,600 acres of present barrens, there are in Hancock county over 5,000 acres which have been reduced almost to a barren condition. Here, if necessary, this industry could be profitably extended. But when lumbering and fires have not materially depleted the forests, the land should be continued under forest cover, and the stand improved. The opportunity is ample for a proper extension of blueberry culture without invading valuable forest lands, which should be protected from fire. The

wisest policy is to utilize the present blueberry barren areas to the fullest extent, and not to encroach further upon the forests, except as the growth of the industry makes it profitable to take old cut-over lands for this purpose.

Irrigation for the East.

The interest of Eastern agriculturists in the practice of irrigation is growing steadily. A recent editorial of the New York *Sun* is pertinent and deserves the attention of farmers and economists alike. The editorial in question is quoted in full:

"The irrigation of our arid regions has commanded much attention, but the system may profitably be extended far beyond them, though the understanding of its value is comparatively new to this part of the Union. A few truck and other farmers in New York and neighboring States have tried it for years, and they have found that irrigation in the East is profitable. A gradually widening circle of agriculturists has been brought over to this view. It is a little strange perhaps that our farmers generally did not take more rapidly to the idea, for they are only just beginning to repeat the experience of farmers in France, Switzerland and Italy, where some of the irrigated districts have a larger annual rainfall than the Mississippi Valley.

"During the past year the Department of Agriculture has been making investigations in our humid regions, particularly in the eastern part of the country. Its report, just published, deals almost exclusively with the irrigation of market garden crops. It was found that many of the market gardeners of Long Island, New Jersey and Massachusetts are beginning to discover that it is very profitable to irrigate their crops. In nearly every season there are periods of little rain during which the growth of vegetables is seriously checked. The proper application of water at these times prevents the diminution of the crops that would otherwise occur.

"At other seasons when the rainfall

is considerably below the normal, irrigation is an insurance against serious damage. These facts have now become so well established that the method is steadily extending among our market gardeners.

"Mr. Bach, of Flushing, in Long Island, who has thirty acres of garden truck under irrigation, estimates that the value of his crops was increased \$5,000 last year by artificial watering. Mr. Rawson, of Arlington, Mass., says that the value of his market garden crops is often increased 50 per cent. by irrigation and nearly always as much as 25 per cent. The testimony is general that the size and quality of strawberries, onions, cauliflower and other small fruits and vegetables are much improved by irrigation.

"With the higher prices for crops and more intensive cultivation that are coming with increased density of population there is no doubt that irrigation will take its place as an important agency in the agriculture and horticulture of the eastern half of the United States."

Reclamation Service Notes.

Mr. W. G. Swendsen has been appointed engineering aide in the United States Reclamation Service. Mr. Swendsen graduated from the Agricultural College of Utah with the degree of B. S. in C. E. in 1904, and during school and vacation months was engaged in various capacities as levelman and assistant engineer in the establishment of water works systems and the construction of pipe lines and canals, as well as reconnaissance work. He assisted the resident hydrographer in gaging streams and general repair work, and from April to December, 1904, was employed in the Reclamation Service on Strawberry Valley and Utah Lake reconnaissance work as transitman and levelman. He is now connected with the work in Utah.

The alumni of the Massachusetts Institute of Technology continues to be drawn upon heavily for engineers by the Reclamation Service at Washing-

ton. Among the recent additions to the personnel of the Government engineers are the following graduates of this institution: T. F. J. Maguire, a native of Massachusetts, as electrical engineer, with headquarters at Denver, Colo.; Howard Scott Morse, who for two years served as assistant in civil engineering of the institute, as assistant engineer in the Reclamation Service.

Ernest F. Tabor, who was appointed assistant engineer in the United States Reclamation Service last year, has been promoted to engineer.

Mr. Tabor attended the University of California, and since 1887 has been engaged in various capacities on engineering work in that State, chief among which are Superintendent for Escondido Irrigation District; location and construction of city water works for Elsinore, California; on river gaggings, irrigation, mining and land surveys. He is at present engaged on reclamation work in Utah.

Horace W. Sheley, who since 1903 has been engaged in the work of the Reclamation Service, has been appointed engineering aide. Mr. Sheley attended Westminster College, Mo., and later the University of Utah, graduating with A. B. degree. He has assisted mining engineers and experts, and been engaged in bridge work as supervisor of construction of concrete and reinforced concrete piers and arches. Since entering the Reclamation Service Mr. Sheley has been employed as draftsman and topographer and in charge of plane table work. He is now connected with the work in Utah.

Daniel Grant Martin has been appointed engineer in the United States Reclamation Service, and placed in charge of work on the Minidoka project, Idaho. Mr. Martin attended the Kansas Normal College, and since 1891 has been engaged as engineer in various capacities on canal construction, in the State of Idaho.

Underground Waters.

A report has just been submitted to the Chief Engineer of the United Reclamation Service by Chas. S. Slichter, engineer in charge of investigation on the movement of underground waters, upon the underflow of the Rio Grande near El Paso, Texas, and Las Cruces, New Mexico.

Above the city of El Paso the Rio Grande passes through a narrow pass, or gorge, which the river has cut out of limestone rock. The river-bed is frequently dry at this point, and it became important to the growing community of El Paso and adjacent settled portions of the Rio Grande valley to know how much water was passing underground through the gorge of the river. The distance to bed rock at the gorge is about 90 feet, measured from the bed of the river. To this depth the channel which the river cut through the rock is filled with sand and gravel, through which the so-called "underflow" of the river moves. This term is now used to describe the ground water that is slowly moving downstream in the sands and gravels which lie beneath the bed of a river. In some river valleys the underflow constitutes a second and unseen river of considerable importance. In many cases the quantity of water that passes downstream in the gravels is very small, and consequently, of little value.

A few years ago Mr. Slichter invented and perfected for the United States Geological Survey a practical method of measuring the rate at which these underflow water move. This method has been put in use in many parts of the country, with much success, by means of which a great amount of valuable information has been collected concerning a matter about which engineers were formerly very much in the dark. The measurements are made by means of electrical instruments, the principles made use of in the method being quite simple. Small wells of two-inch pipe are first driven into the sand, one well being several feet downstream from the well

first driven. Each well contains a few feet of perforated strainer at the bottom, and both wells are driven to the same depth. These small wells are very quickly driven and after use are pulled up and used again. After the wells are put in place, electrical connection is made from a battery to the wells, one pole of the battery being connected to the upstream well and the other pole of the battery being connected to the downstream well. The electrical current will then flow from the battery to the casing of one well through the water in the sand or gravel to the casing of the other well, and thence back to the battery. This current is at first very weak, and by putting a suitable instrument in circuit the strength of the current is automatically recorded on a chart or piece of paper that is moved by clockwork. When everything is in readiness, a strong solution of sal ammoniac is placed in the upstream well, which mixes with the groundwater around the strainer at the bottom of the well, and passes downstream with the moving groundwater. This chemical when placed in water renders the water a good conductor of electricity, so that as the solution passes with the groundwater from the upstream to the downstream well, the electrical current continually increases and is recorded by the instrument. When the salt water finally reaches the downstream well and enters it through the perforated screen. A very simple device permits the current to still further increase, which shows on the record chart of the instrument the exact time at which the salt water arrived at the downstream well, and, hence, the time required for the underground water to move the distance between the upstream and the downstream well.

By means of these instruments, the rate of movement of the underflow at gorge of the Rio Grande was investigated. It was found by this means that the groundwater moved only 3 feet in 24 hours. The amount of underflow passing through the gorge was



Junction of Methow and Columbia Rivers, Washington.



Moses Lake Reservoir Site, Washington.

therefore very small. Unfortunately, the quality of the water at a depth of 35 feet below the surface was found to be very salty, and the water continually increased in saltiness until at 50 to 60 feet it was about as strong as sea-water. For this reason the underflow at this point is of little or no value.

A large number of tests of pumping plants in the valley of the Rio Grande were made, and the cost of irrigation by use of well water was carefully determined. The average cost of water from the pumping plants was about five dollars for each acre of water one foot deep. Test wells were drilled near Las Cruces, New Mexico, by means of which a determination was made of how much water could be safely drawn from the water-bearing sands and gravels of the valley without overdrawing upon the available supply.

**Pike's Peak
Polytechnic
Society.**

This Society is composed of Civil Engineers and Surveyors,

Mining Engineers, Mechanical Engineers, Electrical Engineers, Architects, Irrigation and Forestry Engineers, Geologists, Assayers, Chemists and others who are studying or practicing along technical lines.

Its object is the promotion of intercourse, observation and records in technical subjects, by means of periodical meetings, reading of papers, discussion, special investigation into matters of public and technical interest, the publication of such parts of the proceedings as should be deemed expedient, providing the convenience of a library and reading room for its members and the collection of books and periodicals on technical subjects. It is also the intention to secure the services of prominent specialists in various technical branches represented by the Society, to lecture before the members of the Society and invited guests.

The regular meetings are held on the second Saturday of each month in the Society's rooms in Coburn Library

on the Colorado College campus. The annual dues for resident members are five dollars and for non-resident members, three dollars. There are at present eighty members in good standing. The following officers will serve for the year 1905: President, William Strieby; vice-presidents, B. H. Bryant, L. E. Curtis, W. F. Douglas; recording secretary, E. A. Sawyer; corresponding secretary, W. D. Waltman; treasurer, Ira A. Miller.

On December 1, 1904, Professor W. G. M. Stone, president of the Colorado Forestry Association, delivered an illustrated lecture on the "General Subject of Forestry." January 14, 1905, a general discussion on "Underground Waters" was led by Mr. E. C. van Diest, E. M. and Professor J. H. Kerr. On January 28, 1905, Mr. Clyde Leavitt, Government Forester, delivered an interesting lecture on the "Forestry Movement." A memorial is being prepared for presentation to the Colorado Legislature, urging the passage of the new forestry bill now before that body.

Any questions in regard to the Society or to technical matters in general in Colorado, will be cheerfully answered by the recording secretary or the corresponding secretary.

Canadian Forestry Journal.

Realizing the want of a distinctive medium representing the Canadian Forestry Association, and to enlist public support, that Association has undertaken the publication of "The Canadian Forestry Journal," with Mr. R. H. Campbell as managing editor, and an editorial advisory committee including Dr. William Saunders, Prof. John Macoun and Mr. E. Stewart. The initial number of the magazine is pleasing in appearance, and contains several very interesting articles, together with a number of half-tone illustrations. Friends of the general forest movement will undoubtedly welcome this new publication. It is another evidence of the activity of the Canadian Forestry Association, and a move that should not only bring

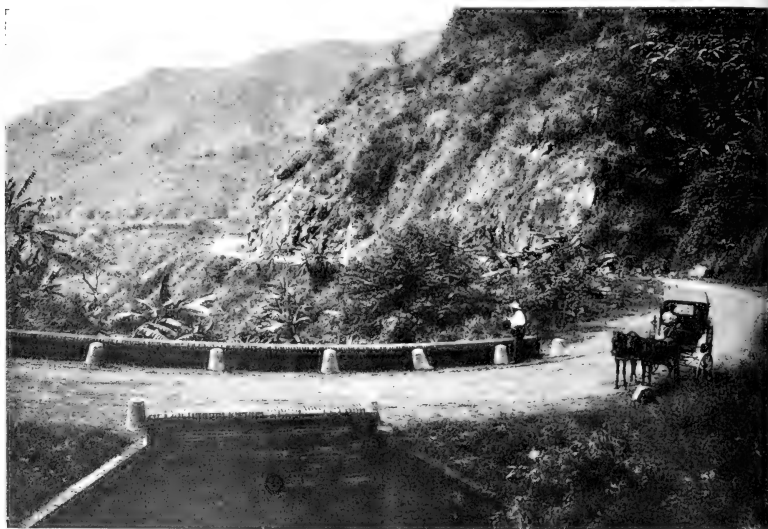
added strength to the organization, but create much new interest in Canadian forestry.

Forest Reserves for New Jersey.

In his inaugural address, delivered on January 17th, the Governor of New Jersey expresses his strong advocacy in the plan to establish State forest reservations in New Jersey, on the waste lands of that State. Governor Stokes says: "Every year the Government is spending thousands upon thousands of dollars in

cessity for the river and harbor appropriations."

We are glad to note the appreciation of forestry by the chief executive of New Jersey. His plan for the regeneration of New Jersey is founded on sound, common-sense principles, and the revenue which the State should derive from forest products—a point which Governor Stokes illustrates with statistics showing the income of the State forests abroad—is a convincing argument. There are thousands of acres of land in New



The Celebrated Military Road which Crosses the Island of Porto Rico.

deepening the channels of our streams that are again promptly filled with soil carried by the rainfall from the treeless plains along the river banks. The same money expended in developing the forests along the streams and around the sources of their supply, would check the rush of water, save the soil that is now carried and deposited in the river channels, and reduce to a considerable extent the ne-

Jersey, part of it mere brush land, part of it abandoned and waste, all of it unsightly, and all capable of growing trees, that would beautify the landscape, afford attractive driveways, furnish places of recreation for the well and health resorts for the sick, and be a source of income to the commonwealth. Much of this land can be purchased for \$1 an acre, and in some cases can be obtained for taxes.



MR. MORRIS BIEN

Supervising Engineer, U. S. Reclamation Service.

One of the most effective members of the United States Reclamation Service is Morris Bien, supervising engineer. He is particularly well fitted for work in connection with the many intricate problems of national irrigation, owing to his having been educated both for engineering and the practice of the law. In addition, his work with the Reclamation Service was begun after nearly twenty-five years of experience in the government service, fifteen of which were in topographic work for the Geological Survey, and nearly ten years in legal work in the General Land Office. Morris Bien was born in New York, April 17, 1859, and graduated in civil engineering at the University of California in 1879, immediately securing employment with the United States Geological Survey in topographic work, which he continued until 1893. In 1895 he graduated in law at Columbian University, and in 1896 received the degree of Master of Laws from the National University. From 1893 until 1902 Mr. Bien was engaged in legal and right-of-way work relating to irrigation, railroads, etc., in the General Land Office. In July, 1902, after the passage of the National Reclamation Law, he was transferred to the United States Geological Survey, where he has since given his attention to legal and land matters with the Reclamation Service. Mr. Bien is a clear headed, practical man, who combines in a large degree those elements that have made the Geological Survey such a highly successful organization. Fitted by temperament and experience for reclamation work, he is rendering the country excellent service.

FOREST RESERVE MANAGEMENT TRANSFERRED

Control of the Reserves Passes from the Department
of the Interior to the Department of Agriculture

ON February 1 President Roosevelt signed the bill shortly before passed by Congress having for its purpose the transfer of the administration of the federal forest reserves from the Department of the Interior to the Department of Agriculture. From now on the reserve work will be directly in charge of the Bureau of Forestry.

Since the creation of the first of our national forest reserves in 1891 the management has remained in the General Land Office of the Department of the Interior. The methods and organization of this bureau were not well adapted to the new problems which arose. The men assigned to the new division were able and faithful, but lacked the special education and experience needed in forest work. Furthermore, Congress held the purse strings tightly and thus hampered the possible development of better ideas. Nevertheless, the new division struggled determinedly with the puzzling questions that arose, and with the advice and assistance of the Bureau of Forestry and the U. S. Geological Survey, decided matters that were beyond the range of its own information.

In 1901 several trained men were detailed from the Bureau of Forestry of the Department of Agriculture to the reserve division of the Department of the Interior. It was hoped that in this way some plan could be devised for establishing practical forestry at once. A year of hard work proved conclusively that the intricate machinery devised for the adjustment of land titles was not suited for the prompt settlement of local questions in forest reserves two thousand miles from the seat of authority. President Roosevelt, the Secretary of the Interior, the Secretary of Agriculture,

and the Commissioner of the General Land Office urged upon Congress the importance of making the transfer of the reserve management. The President said in his last message:

"As I have repeatedly recommended, all of the forest work of the Government should be concentrated in the Department of Agriculture, where the larger part of the work is already done, where practically all of the trained foresters of the Government are employed, where chiefly, in Washington, there is comprehensive first-hand knowledge of the problems of the reserves, acquired on the ground, where all problems relating to growth from the soil are already gathered, and where all the sciences auxiliary to forestry are at hand for prompt and effective coöperation."

On February 1 the President signed a bill which immediately transfers the pending business of the reserves, including timber sales, applications for the free use of timber, permits for grazing livestock, etc., to the Department of Agriculture, and all matters relating to such business will hereafter be referred to and administered by that department.

All officers of the forest reserve service, including superintendents, supervisors, and rangers stationed on the forest reserves throughout the West—a force numbering about 450 men—are transferred to the Department of Agriculture. The employees in this branch of the service were recently classified under the civil service act, and hereafter all applicants for positions in the forest service will be required to pass examination.

The rules and regulations relating to the free use and sale of timber and to the grazing of livestock will be re-

vised at an early date and such changes made in administrative authority and methods as will facilitate the prompt transaction of business upon the forest reserves. Until such revision is made, the present rules and regulations will remain in force, except those relating to the receipt and transmittal of moneys, in which case special fiscal agents of the Department of Agriculture will perform the duties rendered by the receiver of the local land offices in accordance with existing laws and regulations.

The vital importance of forest reserves to the great industries of the western states will be largely increased in the near future by the continued steady advance in settlement and development. The permanence of the resources of the reserves is therefore indispensable to the continued prosperity of the country, and the policy of the Department of Agriculture for their protection and use will be guided by this fact, always bearing in mind that the conservative use of these resources in no way conflicts with their permanent value.

All of the resources of the reserves, including the water, timber, and forage needed for the present and continued prosperity of the agricultural, mining, lumbering, and livestock interests, will

be used in a businesslike way and with as little restriction as will insure a permanent supply of these resources.

The policy of the department in the regulation of grazing will be as liberal as compatible with the objects of the reserves. Every effort will be made to assist the stockmen to a satisfactory distribution of stock on the ranges, for the purpose of securing greater harmony, reducing the waste of forage, and securing a more judicious and profitable utilization of the range.

In the local management of each reserve all questions will be decided with a view to meeting the needs and demands of the people of that particular locality. The dominant industry of each district, whether it be agricultural, mining, lumbering, or grazing, will be fully recognized, and granted such privileges as will be consistent with the proper care of the reserves, and cause as little injury as possible to minor industries. The interests of the permanent settler will always be carefully guarded and every precaution taken to protect him against interests of a more temporary nature, since upon the successful establishment of homes depends the best and most permanent use of all of the resources of the forest reserves.

INFLUENCE OF TREE PLANTING UPON THE DUTY OF WATER IN IRRIGATION

BY

F. H. KING

Professor, University of Wisconsin

IN the effort to discover and establish underlying principles of agricultural science and to direct agricultural practice along lines which shall be in harmony with them, thus leading more directly and certainly to higher economic returns, we stand greatly in need of an increasing body of accu-

rately determined fundamental facts; and it is very much to be hoped that it will be more and more recognized that the development of these fields falls properly within the purpose of Government aid and work. An adequate discussion of the broad problem of how to secure the maximum

duty of water in agriculture is not at present possible on account of lack of a sufficient body of well established facts; and this is especially true of that phase of the problem relating to the influence of tree planting upon the duty of water. The body of accurately determined facts regarding the influence of wind-breaks of any type upon the wind movement close to the surface, and especially upon the rate of evaporation from foliage, soil, and water surfaces, is extremely small, and yet such knowledge is necessary to a proper treatment of the subject. Some general facts and tendencies have been ascertained which are helpful for a preliminary consideration of this subject.

INFLUENCE OF WIND-BREAKS UPON VEGETATION.

There is no doubt but that under certain critical conditions wind-breaks do exert a very measurable influence upon vegetation. In the spring of 1894 (Bulletin 42, Wis. Agri. Exp. Stations) during May and June, an opportunity was afforded to make a somewhat critical study of this subject under field conditions. There is in Wisconsin an area of some ten thousand square miles of light sandy soil or sandy loam, and upon the lighter and more sandy portions of these soils crops are occasionally very seriously damaged by the drying effect of the wind; and the fertility of the soil is much reduced by the drifting which occurs at such times. At the time in question, there had been a heavy fall of rain on the 5th and 6th of May, but on the 7th it was clear and cold with a strong wind blowing from the northwest. During this and the following days, notwithstanding the rain, the soils on many fields about Plainfield and Almond, Wis., had been badly drifted. On the morning of the 8th the drifting had gone so far, on many fields, that at both places, the loose sand with which oats had been covered, whether with seeder or with drill, had been driven from the fields to such an extent as to leave the ker-

nels entirely exposed and the plants lying flat upon the ground hanging by the roots and whipping in the wind. On the fields where the whipping had not been so severe and where oats stood 3 inches high, the oats had been cured like hay close to the ground, and even the leaves of dock sorrel were blackened and so dry as to crumble in the hand. Very many of the blades of oats, through wilting, had broken over close to the ground, presenting an appearance which suggested to the farmers that they had been cut by the sand. It was at once evident, to the most casual observer of the fields at this time, that wherever a field lay to the leeward of any sort of shelter the destructive effects of the wind were either not apparent or else they had not been nearly so severe.

About three weeks after the first serious injuries had occurred a careful study was made of many fields and the results are recorded in detail in the bulletin to which reference has been made. Some of the observations made at this time are cited here in illustration of the decisive evidence regarding the influence of wind-breaks upon vegetation. A north and south road 2 rods wide fenced with wire, along which are scattering trees 10 to 18 feet high, together with a scanty growth of hazel, had a field of oats lying to the east which was greatly damaged; but a strip 2 rods wide, next to the road, appeared wholly uninjured. A field of oats lying to the east of a field of timothy, in which there was a strong growth of dock sorrel, had a strip of oats 200 feet wide next to the grass where the stand was good, while on the eastern half, 30 rods wide, the plants were entirely destroyed. Another oat field having grass on the north and west sides, and bordered by a rail fence, showed a strip of uninjured grain 100 feet wide next to the two fences and fully 200 feet wide in the northwest corner of the field in the lee of the two fences. In another oat field fully five-eighths of it had been so thoroughly destroyed by the wind that it was harrowed and

fitted for potatoes, but a strip along the rail fence on the south side, 150 feet wide, had been allowed to remain on account of the better stand, and on this area, as was usual generally, the number of plants increased as the fence was approached. To the west of this same field there was another of timothy, and adjacent to this there was a strip of oats 200 feet wide where the stand of plants was markedly better than farther away; and the same

injured and the clover had been entirely killed out.

In figs. 2 and 3 the condition of crops which were observed on other fields, and the surroundings which produced these differences, are also shown.

In fig. 2 the southeastern field is 80 rods long and 30 rods wide. Here it will be seen the oats were good along the road in the lee of the two fences, 40 per cent. gone further away, and

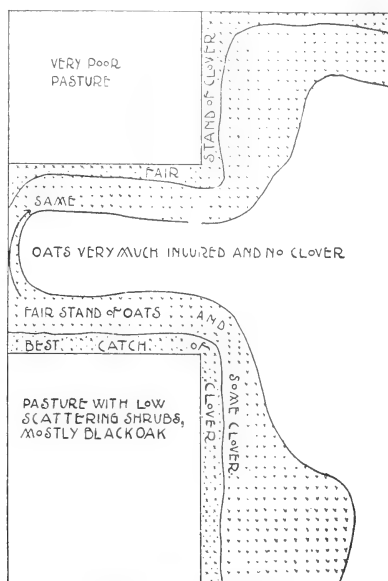


Fig. 1. Showing protected areas of oats and clover in the lee of woods and pasture.

fact was observed in an adjacent field lying to the east of a closely fed pasture free from trees and shrubs. In another field 120 rods long from north to south and 80 rods wide, seeded to oats and clover, the effect of the surroundings upon the crops is indicated in fig. 1, where it will be seen that at a certain distance from the conditions which have influenced the temperature, humidity, and velocity of the wind, the oats had been very much

entirely destroyed on the eastern half. Further north the field of oats adjacent to the field of grass and with woods to the north and in the distance to the west, had a good stand of plants, being seriously injured only at the south, where the wind came through between the two pieces of woods along the course indicated by the arrow. Similarly, in fig. 3, the influence of shelters are clearly and sharply brought about by the condition of the

crops observed and there recorded. The southern field in this figure was 60 rods from east to west and 30 rods wide. It will be seen that the half of the field stretching out into the

three instances, to have exerted very marked effects upon the stand of grain and in one of these fields, on one portion of the protecting corn stubble, there was a strong growth of dock

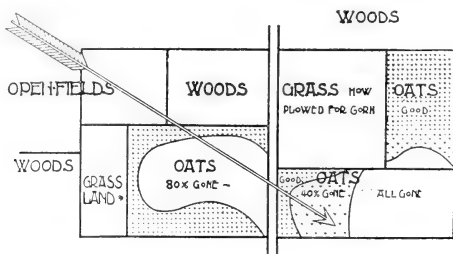


Fig. 2. Showing three fields and surroundings where oats had been entirely killed, together with areas protected from the wind.

path of the free wind coming through the gap between the two pieces of woods, as indicated by the arrow, has lost all of the crop, while the stand increased toward the woods on the west and was good at a distance of 10 to 20 rods from them.

The piece of oats lying on the south side of the scantily wooded pasture was in excellent condition, and although only 15 rods wide, a very appreciable difference could be seen in

sorrel. To the leeward of this part of the field the oats had been much less injured, suggesting that the effect of the humidity of the air passing across this may have been enough altered to render the wind current appreciably less destructive. Observations like these appear to place beyond doubt that, under certain conditions, at least, wind-breaks do exert a very measurable effect upon the vegetation of cultivated fields.

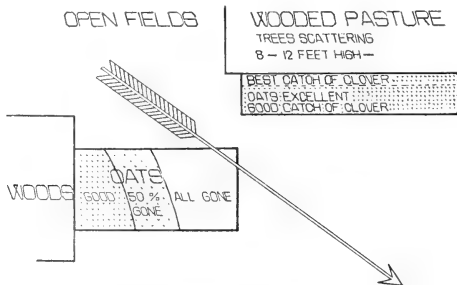


Fig. 3. Showing protection afforded to grain by woods and direction of destructive winds.

the stand of clover, to which the field had been seeded, on the margin most distant from the pasture. Even fields of corn stubble having fields of oats to their leeward were observed, in

On three other oat fields which had been seeded to clover and which were bordered on the west with fields of grass, the number of clover plants upon unit areas which had survived

the effect of the wind was determined at different distances from and to the leeward of the fields of grass. The counts were made in series along east and west lines at right angles to the margins of the grass fields, and the results are given in the following table.

TABLE SHOWING THE DECREASE IN THE NUMBER OF YOUNG CLOVER PLANTS PER UNIT AREA WITH INCREASE OF DISTANCE TO THE LEEWARD OF THE MARGIN OF GRASS LAND.

Distance from margin of grass.	No. of Plants.	No. of Plants.	No. of Plants.	No. of Plants.
Feet.	Series 1.	Series 2.	Series 3.	Total.
Field No. 1.				
50	187	209	187	574
200	120	139	131	390
400	88	75	68	231
Field No. 2.				
100	77	73	99	249
200	55	109	113	277
400	43	78	72	193
600	67	66	56	189
800	54	54	30	138
1000	27	11	10	48
Field No. 3.				
50	377	382	371	1130
100	166	209	225	600
700	203	180	160	543

described, others were made to measure the rate of evaporation at different distances to the leeward of woods, using a form of Piche evaporimeter rendered more sensitive by increasing the diameter of the evaporating surface to 5.9 inches, thus giving an effective area of 27.06 sq. in., deducting the area of the water reservoir, the latter being graduated to .1, c. c. The instrument as placed in the field is represented in fig. 4.

Fig. 4.—Showing the form of Piche evaporimeter as placed in the field.

With a series of 6 of these instruments set up in a line at right angles to the margin of a black oak grove having a mean height of 12 to 15 feet, the rate of evaporation which occurred simultaneously between 11:30 and 12:30 A. M. was measured, with the results given in the next table.

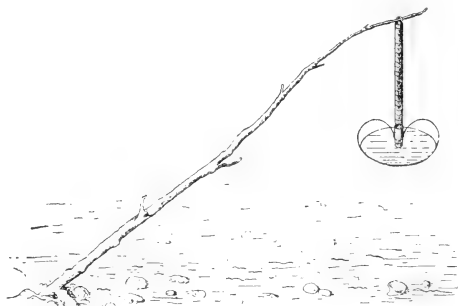


Fig. 4. Showing the form of Piche evaporimeter, as placed in the field.

These three sets of data appear to leave little room to doubt that, in some manner, the grass fields to the windward of the fields seeded to clover did exert an influence which materially affected the stand of clover on them. In what manner this effect may have resulted will be referred to later.

INFLUENCE OF WOODS UPON THE RATE OF EVAPORATION TO THE LEEWARD.

At the time of the observations just

EVAPORATION ONE FOOT ABOVE THE SURFACE AT DIFFERENT DISTANCES TO THE LEEWARD OF A GROVE OF BLACK OAK IN A FIELD OF SANDY SOIL RECENTLY PLANTED TO CORN.

Distance from Woods.	Evaporation in One Hour.
Feet.	C. C.
20	11.0
40	11.1
60	11.3
80	11.2
100	11.0
120	12.9

These results show that until a distance greater than 100 feet is reached but little difference in the rate of evap-

oration was found. At 120 feet the evaporation was 17 per cent. greater than at 20 feet. Three of the instruments were next set up at 20, 40 and 60 feet, and at 280, 300, and 320 feet from the same grove and in the same field. During one hour the amounts of evaporation were as given in the next table.

EVAPORATION AT ONE FOOT ABOVE THE SURFACE AT 20, 40, 60, AND AT 280, 300, AND 320 FEET TO THE LEeward OF A BLACK OAK GROVE IN A FIELD OF SANDY SOIL RECENTLY PLANTED TO CORN.

PLANTED TO CORN.		PLANTED TO CORN.	
Distance from Woods.	Evaporation in One Hour.	Distance from Woods.	Evaporation in One Hour.
<i>Feet.</i>	<i>C. C.</i>	<i>Feet.</i>	<i>C. C.</i>
20	11.5	280	14.5
40	11.6	300	14.2
60	11.9	320	14.7
	—	—	—
Avg. 40	11.66	300	14.4

From this table it is seen that the rate of evaporation was 23.4 per cent. greater at 300 feet than at 40 feet, basing the computation upon the averages.

In another locality the evaporimeters were set up at distances ranging from 20 to 500 feet to the leeward of a piece of black oak woods where they had an average height ranging between 15 and 25 feet and were thicker on the ground. The results secured during an hour of sunshine in the middle of the day are given in the table which follows:

EVAPORATION ONE FOOT ABOVE THE SURFACE OF GROUND IN A FIELD OF OATS AT DIFFERENT DISTANCES TO THE LEeward OF A BLACK OAK GROVE OF TREES 15 TO 25 FT. HIGH.

Distance from Woods.	Evaporation in One Hour.
<i>Feet.</i>	<i>C. C.</i>
20	11.1
100	14.3
200	15.7
300	18.5
500	18.3

In this series the evaporation appears to have become constant at about 300 feet from the woods and was some 66 per cent. greater than at 20 feet distant.

The effect of a scanty hedgerow was also measured. This was composed of a strip of blue grass 16 feet wide in which there were scattered black and burr oak from 6 to 8, and occasionally 12, feet high. The hedge

had open gaps in it and the nearest evaporimeter was set up in the lee of a clump of 6 trees spanning a length of 40 feet, there being a gap of nearly equal length on either side. To the windward of this hedge there was a naked field 80 rods wide recently plowed and being planted to potatoes, and the instruments hung above the field of oats where the plants were about 4 inches high. The next table gives the results obtained.

EVAPORATION ONE FOOT ABOVE THE SURFACE OF A FIELD OF OATS AT DIFFERENT DISTANCES TO THE LEeward OF A SCANTY HEDGEROW.

Distance from Hedgerow.	Evaporation in One Hour.
<i>Feet.</i>	<i>C. C.</i>
20	10.3
150	12.5
300	13.4

In this case the evaporation at 300 feet from the hedgerow was 30 per cent. greater than at 20 feet, and 7.2 per cent. greater than at 150 feet, and the results make it clear that even scanty hedgerows exert a measurable influence upon the rate of evaporation at considerable distances to the leeward.

INFLUENCE OF A CLOVER FIELD UPON THE RATE OF EVAPORATION TO THE LEeward.

Adjacent to the naked field behind the hedgerow just considered, there was a field of clover 360 feet wide along the margin of the oats and extending 780 feet back from it, across which the wind passed in its course from the north. At the same time the last observations were made a similar series was taken to the leeward of the clover, the results being those given in the following table:

EVAPORATION ONE FOOT ABOVE THE SURFACE OF AN OAT FIELD AT DIFFERENT DISTANCES TO THE LEeward OF A FIELD OF CLOVER.

Distance from Clover Field.	Evaporation in One Hour.
<i>Feet.</i>	<i>C. C.</i>
20	9.3
150	12.1
300	13.0

These results indicate that at 300 feet to the leeward of the clover the rate of evaporation exceeded that at 20 feet 39 per cent. and that at 150

feet 7.4 per cent. Comparing the evaporation from the two adjacent areas where, as stated, the evaporimeters were similarly and simultaneously exposed, it is seen that the air coming across the long stretch of naked ground and then passing through the hedgerow, caused measurably more evaporation than did the current which had traversed the field of clover; and these results appear to be in complete accord with the observations cited regarding the stands of grain and clover to the leeward of woods, hedgerows, grass fields and shelters of other kinds.

INFLUENCE OF WOODS AND GRASS
FIELDS UPON THE HUMIDITY OF
THE AIR TO THE LEEWARD
OF THEM.

At the same time that the several sets of observations were taken and at the same places, others were also made with wet and dry bulb thermometers of the Henry J. Green make, reading to tenth of a degree C. The results obtained are given in the following table, each value being a mean of 10 readings, which were made in regular rotation, passing from station to station of each series during the intervals of exposure of the evaporimeters.

RELATIVE HUMIDITY OF AIR THREE FEET ABOVE
THE SURFACE AT DIFFERENT DISTANCES TO THE
LEEWARD OF WOODS, HEDGEROWS, CLOVER
FIELD AND NAKED SOIL.

Distance to the Leeward.	Mean Dry Bulb Readings.	Mean Wet Bulb Readings.	Mean Relative Humidity.
Feet.	Degree F.	Degree F.	Per cent.
Grove No. 1.			
30	65.32	49.46	27.0
300	63.80	47.35	24.0
Grove No. 2.			
20	75.94	58.35	34.6
100	73.13	56.39	33.0
200	72.03	55.83	34.2
300	71.47	55.13	32.8
400	73.63	55.63	29.6
500	73.31	55.94	30.8
On Leeward Margin of Clover Field.			
0	52.48	43.97	48.0
On Leeward Margin of Naked Field.			
0	53.24	43.57	44.0

These four series of observations, although too limited to serve as the basis of general conclusions, are, in a

general way, quite in accord with the records of evaporation which have been cited, and also in harmony with the very pronounced observed protection afforded to oats and clover to the leeward of the various shelter conditions which have been cited. To my own mind, however, the surprise lies in finding such profound differences in crop conditions associated with the observed differences in meteorological and surface conditions. It should be borne in mind, however, in considering these relations, that the meteorological observations were not made at the time the destructive work was going on; hence what differences then existed are not known. The relations which have been observed and pointed out are clearly vital to the reclamation problems of the arid and semi-arid West, and merit full investigation, especially from the standpoint of field conditions.

The very marked influence which has been observed upon the stand of both oats and clover under the conditions cited is undoubtedly, in large measure, due to the character of the soil and to the stage of growth of the crops, the wind coming at a time when the root system of the plants was yet scantily developed and very close to the surface; but the measurable differences in the stand of clover, at such long distances from the conditions which have evidently produced them, leaves little reason to doubt that crops are sensitive to such differences of temperature, humidity, and velocity of the air near the surface as must result from the conditions whose types have been here considered. There can be no doubt that rows of trees along canals and about reservoirs must very materially reduce the loss of water through evaporation from their surfaces, and such observations as have been cited make it hopeful that their influence upon the loss of moisture from adjacent fields and their effects upon crops themselves may be of much greater importance, especially in plains regions; but only fuller investigations can make certain the true relations.

was obtained. The time between planting and harvesting averaged 120 days, and during this time the mean total evaporation amounted to 24.15 inches, or a rate of 20.13 inches per 100 days and a total of 43.08 computed to 214 days. On these evaporimeters the mean yield of dry matter per acre was 13,881 pounds, 10,000 being a large field yield. This observed mean rate of evaporation is, therefore, likely to be some higher than for ordinary field yields under the same climatic conditions, and the indications are that the evaporation from the field surface under crop may not be quite as large as has been found from the continuously wet soil surface. It may appear impossible that such a relation as this can exist, but the probability of it being true is made clearer when it is understood how great is the reduction in the rate of evaporation from soil surfaces when a thin layer at the top is allowed to become dry, and especially if it is loose and in the condition of an earth mulch. The surface of the soil in the plant evaporimeters was maintained in the condition of a good earth mulch three inches deep, and the effectiveness of earth mulches is clearly brought out by the results given in the following table, where the mean amount of evaporation from firm and mulched surfaces of six soil types are given:

EVAPORATION FROM SIX SOIL TYPES DURING 28 DAYS WITH SURFACES FIRM AND UNDER THREE-INCH EARTH MULCHES, COMPUTED TO 214 DAYS—SEVEN MONTHS.

Soil Types.	Surface Firm.	Surface Under Three-inch Mulch.	Difference.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Sandhill.....	14.37	1.57	12.80
Selma Silt Loam...	22.13	5.02	16.21
Pocoson	25.64	7.11	18.53
Norfolk Sandy Soil.	31.87	5.89	25.98
Goldshoro Compact			
Sandy Loam.....	40.85	6.73	34.12
Norfolk Fine Sandy			
Loam.....	49.79	8.70	41.09

These observations were made at Goldshoro, N. C., in June and July, and they show that there is a very great protection against evaporation afforded by three-inch earth mulches; also, that there is a large variation in the loss of water from different soil

types under like conditions through surface evaporation. As the data of this table were obtained during a comparatively dry period, and when the temperature was high, the rates and differences are perhaps as large as are likely to occur, on the average, in the irrigated districts of the West, under such conditions.

In another series of observations made under what must have been conditions closely similar to those of arid climates, columns of capillary saturated soil 10 feet long were maintained under a continuous draught and without moistening the surface, during 314 days where the temperature ranged between 60° and 90° F. The loss of water which occurred was only determined percentagely, but from the weights of the soils per cubic foot the total evaporation, computed to 214 days, must have been very close to the amounts in the next table:

EVAPORATION FROM TEN FEET IN DEPTH OF TWO SOIL TYPES UNDER ARID CONDITIONS CONTINUOUSLY DURING 314 DAYS—AMOUNTS COMPUTED TO 214 DAYS.

Soil Types.	Surface Firm.	Surface Under Three-inch Mulch.	Difference.
	<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
Sandy Loam.....	2.85	2.49	.36
Heavy Clay Loam..	6.55	4.65	1.90

From these observations, and those given in the last table, it is clear that whenever the surface of a field is protected by a layer of dry soil, whether this is firm or loose, the evaporation will be relatively small; but less from the loose than from the firm surface.

It is probable that the losses of water by evaporation from fields in the irrigated districts of the western United States ranges all the way between 1.57 inches and 50 inches from April 1 to October 31. If this is the case, the maximum conservation of soil moisture, through wind-breaks, is likely to be found to lie somewhere between 40 per cent of 1.57 inches and of 50 inches, or between .63 inches and 20 inches for the period April 1 to October 31.

The wind-breaks themselves, of course, transpire not inconsiderable

amounts of water; but when they are planted about reservoirs and along canals, laterals and head ditches, they may draw largely upon water that would otherwise be lost through percolation or seepage; moreover, the land which such wind-breaks would occupy is often, in part at least, neces-

sarily waste land unless used in this manner. But if it shall be found practicable to make the wind-breaks by using fruit or nut-bearing trees so that an annual income will be realized from them, even though it must be small, the promise of a good investment along this line becomes much better.

THE NEW IRRIGATION

(An Apostrophe to El Dorado)

Oh! golden land of Ophir!
 Oh, pleasure ground of gain!
 Where earth's remotest loafer
 Seeks Paradise in vain!
 Where coin is current tender,
 And greenbacks are a drug,
 And money pays the lender
 A profit mighty snug!

Whose roseate buds of Sharon
 Develop into bloom
 Amid vast deserts barren
 And prehistoric gloom,
 While shares of gold and silver,
 Like waves upon the sea,
 Take up-and-downward motion
 To be or not to be.

I fain would sing thy praises
 In all-praiseworthy song;
 But better homely phrases
 Than flavored words of wrong.
 For nowhere in the nation
 This pleasure ground of gain,
 Effects of irrigation
 So long and fast remain.

Just ask the jolly rounder
 Who wets his whistle down:
 Go ask the truth expounder
 Or men of great renown.
 Oh! wondrous land of Ophir!
 And yet so scarce of rain!
 The tramp will have to go far
 To find thy like again.

CHARLES HALLOCK.



TEACHING ELEMENTARY FORESTRY

Washington Schools Giving Instruction in Forestry in a Way
that Should Become Observed Throughout the Country

BY

SUSAN B. SIPE

Instructor in Botany, Normal School, Washington, D. C.

AMONG the resolutions adopted by the American Forest Congress, held in Washington recently, was the following: That all schools, especially rural, should study forests and tree planting in their effect upon the general well-being of the nation, and in

the rural teacher the best lines of development for the rural child. In all branches of manual training, household economics, and school garden work this has been strongly illustrated. We now find the city schools encouraging and working out plans



Normal students stratifying seeds in sand to carry them through the winter.
The seeds are collected in the city parks.

particular upon the wealth and happiness of communities through the modification of local climate.

Strange as it may seem, educational movements that most affect the rural schools originate in city schools. We find the city teacher demonstrating to

as a forerunner of the larger work that will be done in the future in the for the study of elementary forestry rural school. The beginnings of this work may be seen in Cleveland, Rochester, Joliet, Ill., and in the Normal School of the District of Columbia.

On the same principle that there must be trained foresters for the broad subject of forestry, so the teachers of the elementary schools must have instruction sufficient to arouse their interest in tree planting, in tree culture, and tree protection, if only in connection with the shade trees of cities, that the children assigned to their care may be taught the same. In connection with its course in botany, the Normal School at Washington is giving its

regarded as living things having struggles for existence. Attention is likewise called to the interdependence of tree life, birds, man, and insect life, the insect enemies and their prevention. Tree protection, in so far as it touches the city child's life, are included in this course.

Permission is granted the students to collect tree seeds in the parks during the fall season. These are stratified in sand to carry them through the



Normal students laying off a seed bed.

student-teachers such instruction. Considerable attention is given to the identification of the city's trees and those of the surrounding country. There is a woeful lack of knowledge on the part of the young of the names of the commonest trees. To remedy this much outdoor work is done in the parks and suburbs. Attention is given to the winter identification as well as the summer one.

The physiological side of the subject is considered, so that trees will be

winter for spring planting. Only such seeds are collected as will produce trees suitable for school ground planting later, as it is the purpose of the Normal School to supply trees to the city schools in a few years. Through the co-operation of the Bureau of Plant Industry the school is allowed the use of land in the experiment garden conducted by the Bureau on the Potomac Flats. The students, who are all young ladies, do all of the work, marking the rows, preparing the



Preparing the ground by means of a hand-plow.



Weeding the seed bed in July. About five hundred seedling oaks, walnuts, and Kentucky coffee-trees ready for transplanting in spring. The trees will be distributed to city schools.

land by means of a hand plow, planting, and weeding the seed bed during the summer. About five hundred seedling oaks, walnuts and Kentucky coffee trees are ready to be transplanted to nursery rows this coming spring. Bulletin 29 of the Bureau of Forestry is the text-book followed in this work. Lectures are given on turpentine orcharding, the wood pulp industry, lumbering in various parts of our country, destructive lumbering, forest reserves, forest schools and the work of the Bureau of Forestry, il-

all the changes that take place. This work is repeated in the second grade and again in the third.

Correlation of this work with the geography of any grade is accomplished whenever possible. The story of a pine board, life in a lumber camp, past and present methods of obtaining turpentine, the relation of forests to water supply, are familiar facts to a sixth grade boy in Washington.

The Forest Congress did well to suggest this instruction in the elementary schools. When the day comes,



Portion of class at work planting seed.

lustrated by slides loaned by the Bureau.

The effect of this is felt in the city schools. The graduates of the Normal School are appointed to teach in the first grade. Among the first lessons they give to the little ones is one on the trees immediately in front of their respective school buildings, followed by others in the neighborhood. The children watch these trees throughout the school year, noting

as it must come, that the training of the public schools will fit a boy for the vital problems of living, the training of the future forester will begin with his first years in school. The popular knowledge thus spread by the graded schools among the masses will rapidly accomplish the purpose of the Congress. This, too, establishes the place, and a very valuable place, of woman in forestry—that of the teacher.

THE RECLAMATION SERVICE

Progress of Leading Projects--Land Withdrawals--Letting of Contracts

Shoshone Project in Wyoming.

ON the main thoroughfare leading into the Yellowstone National Park from the east, in a region of wild and wonderful topography, the Government engineers are engaged upon an irrigation project which is destined to convert a vast area of desert into fertile and productive farms. The main area of land to be irrigated is located in the northern portion of the so-called Big Horn basin, on the north side of Shoshone River, seventy-five miles east of the Yellowstone Park.

Field investigations and surveys were begun on this project in May, 1903, and have been carried on since by Mr. Jeremiah Ahern, district engineer. The reclaimable area is approximately 200,000 acres, located on both sides of the Shoshone River below the canyon. The land is of general good quality and, as shown by large areas already under cultivation in the immediate vicinity, will be highly productive when irrigated. The Shoshone River, which furnishes the water supply, has a drainage area of 1,250 square miles extending into the mountains to an elevation of over 12,000 feet. Measurements and gagings of the river have been maintained since 1892, and show a mean annual run-off of about 1,000,000 acre-feet, with maximum floods reaching up to 15,000 cubic feet per second or more in the early summer, and running down to 250 cubic feet per second or less during the winter. The great variation between the maximum and minimum flow necessitates impounding the flood run-off to secure a regulated supply for the irrigation of large areas. An excellent storage reservoir site has been found on the main stream at some distance above the land to be irrigated, the dam site being in a granite canyon. Just below the junction

of its two main forks the Shoshone River enters a very narrow canyon, four miles in length, one mile of which is in solid granite walls rising nearly perpendicular several hundred feet. At the point selected for the dam the canyon is 65 feet wide at the bottom, and at an elevation of 240 feet, the height of the proposed dam, 180 feet wide. The reservoir created by the dam will have a storage capacity of 580,000 acre-feet. Owing to the perpendicular canyon walls, it will be necessary to design a tunnel to provide for the discharge of a wasteway for excess floods to pass the dam.

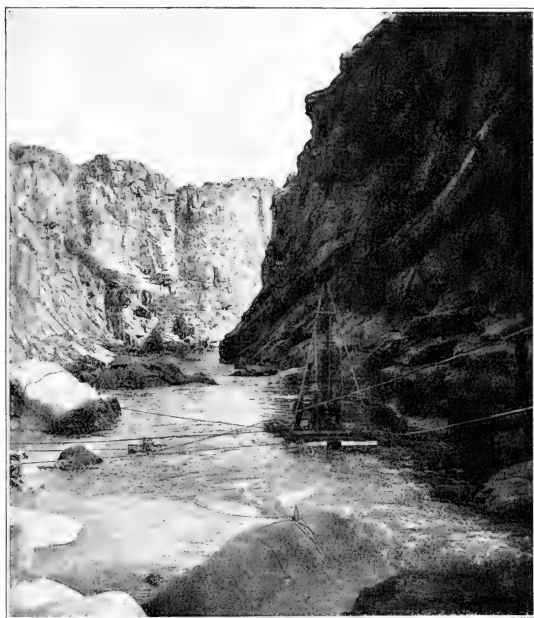
This tunnel will be constructed from the surface of the proposed reservoir through the solid granite of the mountain, and will discharge the water into the river several hundred feet below the dam. The capacity of the tunnel will be 25,000 cubic feet per second, ample to carry the largest floods of the stream. The outlet works will have a capacity of 2,500 cubic feet per second, the discharge being through a tunnel excavated in the solid granite walls of the mountain at an elevation of 60 feet above the stream bed. The tunnel will be 14 feet square, discharging under pressure, and will be controlled by a series of gates at the intake end. As originally designed, 150,000 acres on the north side are to be supplied through a simple high line conduit having a total length of about 75 miles, decreasing in carrying capacity as distributory canals are taken out.

The first three and a half miles of the main canal will be through the canyon and mostly in tunnel, the remaining distance by canal, which at the head will be 60 feet wide on the bottom with water eight feet in depth. Diamond drill borings were begun at the dam site in August, 1903, to determine bed rock conditions, depth, etc.

The preliminary investigations seem to indicate that bed rock would be found close to the surface, but the diamond drillers discovered an altogether different condition. From the very first large boulders and heavy gravels were encountered, and the drills penetrated to a depth of 88 feet before bed rock was reached. This unexpected depth to foundation will

This inclosure can then be heated so that the work may be carried on during the winter season. In order to handle the water which will be encountered by excavating the foundation for the dam, an unusually large construction power plant will be required.

Exceptionally good local conditions for such power development exists



North Platte River, looking downstream from just above dam site
at Pathfinder Reservoir, Wyoming.

increase the expected time to finish the storage dam by at least two years, since the loose material at the bottom of the canyon will all have to be excavated in order that the masonry work of the dam can be erected on bed rock throughout. As the canyon is exceedingly narrow, it will be feasible to inclose the entire area to be covered by the dam, and including the dam itself.

here by using the water in the stream and natural channel through the canyon, or by the use of a steam plant, the fuel for which recently has been found within ten miles of the work. The reclamation of 150,000 acres of land through the construction of this work will add a population of approximately 50,000 inhabitants to what is now a very sparsely settled community.

The Pathfinder Project.

The investigations on the Pathfinder project began in April, 1903, and have been pushed energetically ever since. The preliminary work has reached a point where contracts have been let for a portion of the work and actual construction will be started in a few weeks.

The Pathfinder project contemplates the storage of the flood and surplus waters of the North Platte-River in an immense reservoir, which will be made by constructing a high dam in a narrow canyon of the stream. The annual discharge of the river is approximately one and a half million acre feet, and the reservoir will be capable of holding back all the surplus and flood waters of the entire year. It is proposed to hold back the floods until the irrigation season, when the water will be permitted to flow down the channel of the stream for a number of miles, and thence be diverted by a low diversion dam into canals, which will carry it upon the lands to be reclaimed.

This reservoir will serve a double purpose; it will eliminate for all time the destructive annual floods of the stream, and will furnish an abundant and perpetual water supply for a vast area of land now desert and worthless. The canal system required for this project will be the longest in the United States, the main canal having a total length of 140 miles, and supplying lands in two states, Wyoming and Nebraska. The reclaimable area has not been finally ascertained, but the present surveys indicate a total of 300,000 acres that can be easily supplied.

As in case of all government projects, complications of prior rights and private ownership have been encountered, some of these interests being exceedingly powerful and disposed to obstruct the progress of the work. The citizens of both states almost without exception are urging the Government to proceed, and it is believed in view of the attitude of the public that these complications will be removed in a short time. The lands to

be reclaimed are of great fertility and adapted to a wide variety of products. Above the canal line and extending for many miles in both states is a vast range furnishing free grazing for thousands of cattle.

Diamond Drill Work.

One of the most essential details connected with the preliminary investigations of a large Government irrigation project is the work of the diamond drillers. As soon as the reconnaissance surveys indicate a feasible project the diamond drill outfit is sent out to discover the availability of the dam site. In all cases where dams are to be built it is absolutely impossible to determine the number of yards of excavation to bed rock until careful examinations have been made with the diamond drill. The final plans of a project, estimates of cost, the kinds of structure—in fact, nearly all the important features connected with the work—are dependent upon the results of the borings. It frequently happens when the borings are completed that all the preliminary plans must be altered. Occasionally the whole project is abandoned.

The high structures which the Government is erecting must rest upon solid foundations. Melting snows or cloudbursts on the mountains embraced in watersheds covering thousands of square miles rush down steep slopes and converge in the narrow channels of these pent-up rivers. The floods beat with almost resistless force against the impounding dams that block the way. They must be constructed as firm and as enduring as the everlasting mountains from which they are being hewn.

The eye of man alone cannot safely determine the location of the immovable rock upon which these great structures must be builded. Surface indications offer no safe guide; but the diamond drill, penetrating the gravels, boulders, shales, and shattered formations, finds at last the permanent base. An example of the fallibility of superficial investigations of dam sites was

shown recently during the preliminary reconnaissance of the Shoshone project in Wyoming. At the point selected for a dam the river had cut through a deep and narrow granite canyon and apparently flowed over rock of the same formation. All indications were that bed rock would be found at a depth of ten feet maximum. On putting a drill at work, however, it was

it. The borings did show, however, that there was 30 feet of gravel and boulders underlaid with soft material—quick sand—which would not permit the building of a heavy structure. On the Colorado River a desirable site was discovered, so far as the surface conditions indicated, where a point rock stood ten feet above the water surface. Two hundred feet



North Platte River, looking upstream from Dam site at Pathfinder Reservoir, Wyoming.

shown that bed rock was 88 feet below the bed of the river. What looked to be a thin layer of gravel proved to be 88 feet of gravel and slabs that had fallen from the canyon walls, some of these being 30 feet in thickness.

At one diversion site on the North Platte River, where conditions seemed favorable for bed rock at 25 feet, borings to a depth of 90 feet failed to find

away borings 120 feet below river bottom failed to find solid foundation. In a great many cases a few hundred dollars expended in borings have resulted in changing the location of dam sites, and, of course, have saved many thousands of dollars.

The same conditions hold good in the examination of reservoirs, where natural depressions are used to store

water. Here it is necessary to determine whether the bottom is impermeable or whether it has a subterranean outlet which would let the water out after it had been stored.

Uncompahgre Bids Rejected.

The bids received by the Department of the Interior in response to advertisement of November 28, 1904, for the construction of a frame building at Montrose, Colorado, for the use of the Reclamation Service, have been rejected by the Secretary of the Interior. The bids were as follows:

Hansen & Nissen, Denver, Colo., \$7,969.00; E. B. Johnson, Denver, Colo., \$6,782.00; J. H. Antrobus, Montrose, Colo., \$6,223.20; M. A. Masters, Montrose, Colo., \$6,043.26; H. A. Meredith, Montrose, Colo., \$5,690.00.

In view of the fact that the lowest bid was in excess of the amount set aside or believed to be necessary for the construction of the building, the Secretary has ordered that new plans and specifications be prepared and new proposals advertised for.

Contracts Awarded In Arizona.

The Secretary of the Interior has awarded contracts for furnishing 50,000 barrels of fuel oil, and hauling same and miscellaneous freight from Mesa to Roosevelt, Arizona, in connection with the Salt River project, in that territory.

The contracts were awarded to the lowest bidders, as follows: C. R. Eager & Co., of Los Angeles, Cal., for furnishing and delivering oil at Roosevelt, Ariz., at \$3.98 per barrel; Wolf Sachs, of Tempe, Ariz., for hauling miscellaneous freight from Mesa to Roosevelt, Ariz., at \$13.60 per ton. The Secretary fixed the amount of bond to be supplied under the oil contract at \$15,000, and under the hauling contract at \$5,000.

Notes on Oregon Reclamation Work.

Land owners under the Malheur project in eastern Oregon are becoming each day more desirous of early action by the Government on this

work. The Water Users' Association has worked out a form of agreement to arbitrate the value of present ditches and water rights, but much yet remains to be done to insure early construction.

Field work under the direction of Engineer J. T. Whistler was completed during November, and the force is now busily engaged in making drawings and computations. Work with diamond drill at diversion dam site was completed December 24.

Work on the Carty reservoir site, in connection with the Umatilla project, was completed during November. It is estimated that over 200,000 acre feet can be stored at a cost which will probably not exceed \$10 per acre foot.

A preliminary canal line was surveyed from this new reservoir site to John Day River, and levels carried some distance up the river. The river runs in a more or less abrupt canyon from 500 to 1,000 feet deep. In the lower part of its course the canyon is not so precipitous, and it is possible a project may be evolved at a cost of from \$30 to \$40 per acre irrigated.

The feed canal line will be 75 to 100 miles long, but with the water supply from this source all the land which falls below the canal can be easily watered. While under this scheme there will be from 25 to 50 miles of heavy rock work, it is desirable if possible to utilize this source of water supply, that the waters of Umatilla River may be left for lands to the east and north of the stream at some later period when they have become more valuable.

Several gaging stations were established in the State of Oregon during the month of December for the purpose of securing data as to stream flow in connection with projects investigated last season in the interior of the state.

Land Withdrawals.

Pending further investigation, the Secretary of the Interior has temporarily withdrawn from any form of disposition whatever the following de-

scribed lands in the State of North Dakota for irrigation works in connection with the Buford-Trenton project: Fourth principal meridian.—T. 150 N., T. 100 W.; Sec. 21—N. E. $\frac{1}{4}$ N. E. $\frac{1}{4}$.

Pending further investigation, the Secretary of the Interior has withdrawn from any form of disposition whatever the public lands in the State of Montana in connection with the Madison River project, as follows:

Montana principal meridian.—T. 1 S., R. 1 E.; all secs. 1, 4, 5, 6, 7, 8, 12, 13, 17, 18, 19, 20, 24, 25, 30, 36.

T. 2 S., R. 1 E.; all secs. 1, 12, 13, 24, 25, 34, 35, 36.

T. 3 S., R. 1 E.; all secs. 2, 3, 9, 10, 11, 15, 16, 21, 22, 27, 28, 33, 34.

T. 1 S., R. 2 E.; all secs. 6, 7, 18, 19, 30, 31.

T. 2 S., R. 2 E.; all secs. 6, 7, 18, 19, 30.

T. 1 S., R. 2 W.; all secs. 1, 2, 3, 4, 12, 13, 24, 25.

T. 1 N., R. 1 E., all secs. 25 to 29 inclusive, 32, 33, 34, 35, 36.

T. 1 N., R. 2 E.; all secs. 30 and 31.

T. 1 N., R. 1 W.; all secs. 1, 2, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36.

T. 2 N., R. 1 W.; all secs. 1, 2, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 35, 36.

LUMBERING IN FOREST RESERVES

Millions of Feet of Lumber are Annually Cut with Regard to the Future of the Forests

FEDERAL forest reserves are now fixed facts. It is a serious thing to withdraw from settlement, as the Government has done, some 63,000,000 acres of land. But when the character of this land is understood, and the purposes the reservations will accomplish are known, it will be generally recognized that the area permanently reserved will serve the public best under forest cover. Its topography and soil unfit it for agriculture, but it is admirably suited to tree growth. Wisely administered, it will continuously furnish an immense timber output, while its influence in conserving the water supply for vast dependent agricultural areas will prove of inestimable value.

Without the establishment of reserves, proper control of the public forests is impossible. The present free use of timber is being greatly abused, and there is practically no management of these vast resources and no income from them, unless the timber and land are both sold outright and together. After the establish-

ment of a reserve settlers within its boundaries and those living in its neighborhood are allowed, within definite and reasonable restrictions, free use of timber actually necessary for their domestic needs. The great change for the better, however, is that the reserve laws provide for the sale of timber in small or large quantities to persons both in and outside the reserve. Thus the forests can be made self-supporting, and through funds created in this way they can be protected from fire and be made more productive and useful.

But in making these sales the future of the forest is more considered than the money return from the timber cut. Hence the sales are strictly guarded by bonded contracts between the individuals and the Government. The contracts specify the amount of timber bought and the price to be paid, limit the area and time of cutting, prescribe simple and practical regulations to guard against fire, and cover all essential relations between the contracting parties pending the comple-

tion of the contract. No trees can be cut except those previously marked by a Government official. Under such contracts millions of board feet of lumber are annually being cut from the reserves, to the improvement of their condition.

It is not the Government's purpose to maintain the reserve forests untouched, but to use and develop them. Proper lumbering is as necessary to a productive forest as protection. Mature or ripe trees should be cut not only for the same reason that wheat or corn is, to save and utilize the product, but also to promote reproduction. Agricultural crops require sowing or planting each year, but forests, properly thinned by cutting, reproduce themselves and furnish a continuous crop. That this work may be effectively accomplished there must be protection from fires and proper conditions for tree growth must be maintained. Important among these conditions is the demand of trees for room and sunlight. The young growth must be neither crowded nor shaded out. Thus, for the best results in reproduction the mature trees should be cut, and the dead and diseased timber should be disposed of as rapidly as possible.

Lumbering, however, as heretofore conducted, has had little concern for the effect of its operations on the forest. The immediate purpose was limited to getting out the valuable timber quickly, and little or no attention was given the damage to young growth, necessarily resulting from reckless tree cutting. Reserve management will stop reckless lumbering. The future welfare of the public forests depends on wise regulation of lumbering under such expert control as only the trained forester can exercise. This control must prevent injury to young growth from tree felling, must provide for thinning the forest so as best to assist reproduction, must where necessary resort to tree planting to rebuild the forest, and, most important of all, must prevent or quickly suppress all fires. None of these ends can be successfully attained while the forests remain public lands under no apparent control. Putting them under reserve is reclaiming them from an ungarded and unproductive state. It is the first step in putting them to their best use, through which lumbering and all industries depending on them will most permanently and largely thrive.

UNIQUE STEAM LOG HAULER

Now in Use on Former Chippewa
Indian Reservation, Minnesota

BY

EUGENE S. BRUCE

Lumberman, Bureau of Forestry

THE accompanying illustrations will give the interested reader a clear idea of a steam log hauler used by some of the progressive lumbermen of the Northwest for facilitating the long-distance hauling of logs. It is used in localities where the distance

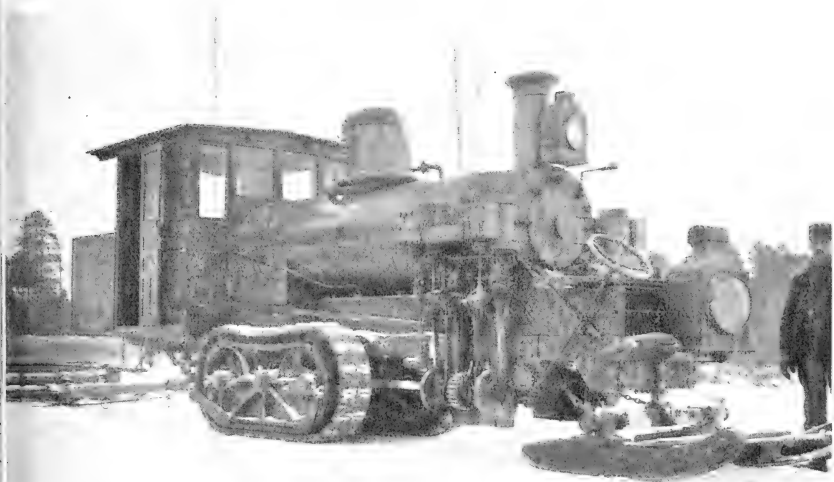
which the timber must be transported in order to reach desired streams or railroads is so great as to prohibit its being hauled by teams profitably.

The construction of this steam log hauler involves an adaptation of the general principles of the ordinary

geared locomotive, suitable wheels especially constructed for the purpose, taking the place, on the axle, of the main driving wheels. These wheels are covered with an endless chain or sectional metal belt which is forced to revolve by the revolution of the driving sprocket wheels. The greater portion of the weight of the boiler and locomotive rests on the revolving sections of the metal belt, which are

be turned in any desired direction by the man piloting the hauler, with a lever purchase wheel similar to the guiding wheel on an automobile or an ordinary brake wheel on a car.

The hauler is not confined to forward motion alone, but can be reversed as quickly as any locomotive of this type, and may be guided by the runner sled into any desired position. That it is a practical suc-



Steam log hauler in use on the former Chippewa Indian Reservation in Minnesota.

armed with teeth or calks, these being set into the sections transversely. The calks are driven into the ice road by the weight of the machine, thus giving the hauler its traction or friction power for starting and keep the heavily loaded sleds in motion. The front end of the hauling engine rests on the center beam of a movable sled, which is so constructed that it will run forward or backward, and may

cess has already been demonstrated. The rate of speed which can be maintained with a load of trailers (coupled log sleds) is from five to seven miles an hour. It is confidently expected that this hauler will be able to handle ten pairs of loaded log sleds on each trip when the roads are in good condition, each pair of sleds carrying 10,000 feet of logs B. M. (log scale).

The hauler shown in the illustration was constructed for the Northland Pine Company for use on their own operations, and is at the present time being used by them to haul the logs and timber from three of their lumber camps on the former Chippewa Indian Reservation, in Minnesota, to Pine River, a tributary of the Mississippi. This is an eight-mile trip each way, on which it is expected to make four round trips each day of twenty-four hours.

One of the advantages claimed for this machine is that it does not get tired nor have to stop to rest, a change of the operating crew being all that is necessary to keep "the bull of the woods" moving night and day. Another advantage is that on the return trip to the woods with the empty sleds, when its load is the lightest, the

hauler pulls its sprinkling tanks loaded with water for icing the log road, also its rut cutter for clearing out and deepening the rut in which the sleds run, thus practically keeping its track or roadbed in condition for constant use, without any additional help, other than the regular crew working with the hauler. It will be readily understood by the experienced lumberman that this steam hauling device economizes largely in the cost of team hire, which is one of the heaviest expenses of a lumber camp, especially where the haul is long. Besides it gives the operator a chance to use his teams in skidding and in hauling the loaded trailers from the short branch roads out to the main log road, over which the steam hauler passes on its regular trips to and from the landings.

FORESTRY IN CALIFORNIA

A State which Appreciates the Value of its Forests and is Taking Active Measures to Protect Them

CALIFORNIA has over 28,000,000 acres, or over one-fifth of its total area, under forest cover. Much of this land is finely timbered, and, with forest management, will be increasingly valuable for the wood which it can supply. But in California the forests have another use, which, as is well understood in that State, is even more important than the production of timber—to conserve the water supply. The wonderful agricultural development which irrigation has made possible is perhaps the largest fact in California's recent economical history. Because of the need of water and the fear of floods public sentiment in favor of forest protection in California has always been well in advance of that in other States, as was conspicuously illustrated after President Cleveland, in 1897, proclaimed the thirteen Federal Reserves created at the close

of his administration. Everywhere else in the West the opposition aroused was so strong that the proclamation was soon afterward temporarily suspended; but a special exception was made in the case of California, where public opinion was from the first strongly in favor of the reserves.

Something less than one-third of the entire wooded area of the State is now embraced in the Federal forest reserves. That the remaining 20,000,000 acres of its forests may be made to serve the public interest in the fullest possible measure, the State has solicited and secured the cooperation of the Bureau of Forestry in working out a proper forest policy for it. Members of the Bureau have, since July, 1903, examined over 21,000,000 acres of forest and brush lands, and by the end of the year the entire State will have been covered.

The different types of land—as timberland, chaparral, pasture and agricultural land, barrens, cut-over land, and burned land—will be mapped and the stand of timber in each location will be roughly estimated. Forest reserves may be increased in number or size, if land most suitable for that purpose is found.

But the subject of paramount importance is the prevention and control of fires. A good opportunity for experiment along this line was afforded the Bureau by coöperation with the private owner of an 80,000-acre tract, who had previously introduced a crude fire-protection system. A comprehensive plan was outlined and its execution begun. There has not been time for a thorough trial, but its installation has had an excellent effect. The patrolling of the tract has been greatly improved, and the neighbors now voluntarily report all fires, whether on or off the tract. There has not been a serious fire on that tract this season. This splendid showing is an impressive object lesson. It proves the efficiency of intelligent care and of fighting fires at the start. The present fire laws of the State are incomplete and inadequate. One result of the work of the Bureau will be the recommendation of a fire law which, if adopted, will be the best ever passed by any State.

The most encouraging fact in forest management is the growing determination of large timberland owners to employ private foresters to handle their holdings. This will ensure a method of lumbering less wasteful than that at present practiced, and, more important by far, it will be the means of better protecting the forests and making them yield a continuous crop. Such expert control will be especially valuable in solving the prob-

lem of the best way to get rid of the slash, which, until burned, is a constant menace to the forests. Extensive experiments in slash burning have already been carried on by the Bureau with satisfactory results.

The Bureau agents are also studying the habits and rate of growth of sugar and yellow pine to determine the practicability of lumbering so as to secure a second crop. The field work on these studies is now about complete. A report on what growth and returns may be expected from plantations of different species of gum is nearly ready for transmittal.

The study of chaparral has led to fruitful practical conclusions. It shows in California the same remarkable ability to encroach upon and spread over open country that it exhibits in Texas and elsewhere in the semiarid portions of the southwest. It makes a satisfactory watershed cover, and almost constantly replaces a forest destroyed by fire. Its composition varies with aspect and elevation and with damage by fire.

The natural reproduction of forest trees has been thoroughly investigated by the Bureau, together with the extent of the forest in the past, the effect of fire upon forest reproduction, the contest between chaparral and forest on burned areas, and the rate of growth of young forest trees. Every State which has large valuable forests or a climate which demands extensive irrigation for farming purposes should, in its own interest, adopt a definite and enlightened forest policy. Work similar to that nearing completion in California should be in progress in at least a dozen other States of the Union right now, if vast timber resources are not to be further ruinously depleted and farming interests are to be properly safeguarded.



APPARATUS FOR DISTILLATION OF WOOD

Description of How Turpentine, Wood Alcohol, Wood Oil, and Acetic Acid May be Collected at Low Cost

BY

J. A. MATHIEU

Chemist-Engineer, and Patentee of Retorts

THIS apparatus (No. 769177, Patented Sept. 6, 1904,) is composed of a vertical clay or cast-iron retort built above a fireplace, the flues going all around the retort. The rosin and turpentine escape by outlets and pipes at lower part of retort. An outlet near the top is connected with a condenser, and a cover made of clay is adjusted in top of retort. There is also a cooling cover of general cylindrical shape and of about the size of the retort. It is preferably made of sheet metal. It is open at the bottom, but closed at the top, with the exception of a central aperture, to the upper side of which is fitted a lid. Other parts are a crane for handling the basket, cooling cover, and retort cover, and a shallow water bath made of iron or wood.

Sticks of wood four feet in length or less are transferred from the car into the basket, which has a capacity of one cord. The basket is raised by the crane and brought over the empty retort and lowered. A cover is put on top and the rosin and turpentine run out by the outlet at bottom. The wood vapor is carried by means of the upper pipe to the condenser. The gas which is not condensed is brought back through an iron pipe and burned in the fireplace underneath the retort; this gas gives intense heat.

After sixteen hours the wood is transformed into charcoal; the cover is raised up, and a cooler adjusted on the top of retort. A rod passing through the top of the aperture goes down and catches the knob of basket

and raises it up inside the cooler. So far as is necessary it goes over the other retorts and they are carried by an overhead track and lowered down into the shallow bath.

The small aperture is covered and a stream of water is run on top of the cooler and cools down the charcoal in three or four hours. The cooler is taken off; the basket of charcoal is hanged and carried to the charcoal shed and dumped on a platform. Afterwards the basket is taken to the yard to be filled up again with wood. The turpentine and rosin are distilled and purified. The products which are going to the condenser are allowed to settle the liquid part that contains the wood alcohol, which is purified by distillation. The products settled on the bottom are separated by distillation and give turpentine, wood oil, light wood oil, heavy wood oil, and what is left is pitch. All these products are in good demand and can be sold very readily.

The advantages of this patent retort, as compared with the ordinary charcoal kiln, are:

A plant can be put upon one-tenth of the ground needed by charcoal kilns.

Less length of pipe will be needed for this retort.

The retort being placed in a vertical position, the heat is applied more regularly and does not require so much fuel.

A smaller quantity of brick will be needed, and the repairs to brickwork

and retort will be considerably less.

Sixty per cent of the labor needed for a kiln may be saved, for the wood is handled by workmen from wagon or car to the basket, and afterward all work is mechanical as far as putting the charcoal in the car, and in case the charcoal is used in blast furnace, the contents of the basket can be dumped right in the blast furnace.

The gas not condensed is used in the fireplace to heat the retort, and if the wood is dry there will be nearly enough gas to keep the operation going without more solid fuel.

The hot gas, after having heated the retort, is conducted underneath the boiler to make steam.

The hot water coming from the condenser is used to feed the boiler.

This retort I guarantee will make sixty bushels of charcoal per cord of seasoned hard wood.

The charcoal will be free of water, and consequently reduce more ore in a blast furnace, and will be more regular for the use for the manufacture of mining powder.

The amount of wood saved will pay for the plant in less than one year. The vertical position of the retort will allow the turpentine and rosin to run down from the wood without distillation and consequently will be superior and more easily purified.

The vertical position of retort will allow the wood vapor, alcohol, and acetic acid to escape to the condenser without being decomposed; thus the quantity obtained will be greater.

The retort made of the fire clay or cast iron will stand a great deal longer and require less repairs.

This system of retort can be utilized for the distillation of wood, peat, lignite and bones, garbage, and extraction of quick-silver, by making some slight changes.

The working of the system of retort is very simple and does not require the services of a chemist to superintend the work; an intelligent man can do perfectly as well after he receives the necessary instructions.

WOOD AS FUEL

BY

T. S. GOLD

HAVING watched for more than three-quarters of a century the burning qualities of wood in an open fire, I have become somewhat familiar with the peculiarities of many species.

Snapping first attracts our attention. Some woods burn quietly, others always snap—some only occasionally. I do not know what causes snapping. It may be the production of an explosive gas, the result of heat or combustion, or the liberation of an explosive vapor from resinous products in the wood, but neither of these theories explain all cases and conditions.

I will first name some species that I have never known to snap and give some of their burning qualities.

Apple is always a quiet burner and when dry burns freely. It leaves an abundant and beautiful white ash which tradition says was used in cooking in place of pearlsh not many generations ago.

Pear, quince, and shad bush burn in a similar manner, but less freely.

Cherry of all varieties, peach and plum make fair fuel, but are inferior to apple. I have never known them to snap, except one tree of black cherry. It is reported that the peach is planted in the vicinity of Buenos

Ayres for use as fuel, as the fastest growing tree.

Burch of all varieties burns quietly. Black birch is the best, and will burn well green. All species of birch should be cut and split while green, that the wood may season properly. Locust burns quietly, but slowly, resisting the fire and melting away with little blaze, as does also the mulberry. White ash and black ash burn quietly, but the former is the best fuel, especially for burning green. The wood choppers of charcoalwood have their own fuel free, presumably from the dead wood, which is not suitable for charcoal, but make free with any nice white ash or hickory standing near their cabins. In the days of the old ovens, white ash was the favorite wood for heating them, as it split readily and burned freely with an abundant blaze.

Elm, willow, and alder are rather soft, spongy woods, that burn quietly, but are not very lasting, nor do they produce very much heat. Hornbeam and blue birch I have never known to snap, and are free burning hard woods. Soft maple never snaps, and when dry makes a very pleasant, still, free-burning wood. The tulip-tree or white-wood, is too valuable for lumber to be consigned to the wood-pile, yet the refuse is easily worked up, and is a free-burner, making a quiet fire.

Spruce, hemlock, fir, cedar, tamarack, and larch always snap; if well seasoned and put in a close stove with a good draft, as soon as the fire is lighted, they give the sound of a pack of exploding fire-crackers, and a sensation of warmth before the cold iron is heated through. All kinds of pine are liable to snap, but the sparks from all these soft woods will die before they scorch the rug, or singe the floor.

Chestnut and butternut are lively snappers, and when dry burn freely, and, being easily worked up, make satisfactory fuel for close stoves. Hickory, the best of all woods for fuel, and keeping fire in buried coals, ordinarily burns quietly, but sometimes it throws live coals viciously across the

room. Hard maple, beech, and white oak sometimes throw out hard coals from the heart wood. When well seasoned they are little inferior to hickory in free and enduring burning qualities. The other oaks rarely, if ever snap, but do not burn as freely as the white oak, nor make as firm coals. The common poplar, though a soft and spongy wood, will snap, and when made into charcoal has the reputation of holding fire in the inside of the large pieces, unseen on the outside, and later starting fire in the coal bank or wagon.

Woods to burn green are: White ash, hickory, black birch, hard maple, and white oak. They are more enduring than when dry and kindle almost as readily. To get the best value of wood, it should be cut and split when green and soon housed in a shed or well ventilated wood house, where it will dry without molding. White pine allowed to lie with the bark on the logs, or without splitting, will be devoured by worms during the first summer. They make such a noise in their work that they can be readily heard.

All wood that is left without working up, suffers from worm and incipient decay, mostly in the sap wood. Live wood makes better fuel than when it has died from fire, or other causes. When the butt cut is sound, it will make better charcoal, more weight than the higher cuts, and has relatively the same value as fuel. In old timber, the butt has sometimes lost its life and substance, and is inferior to the rest of the trunk. In most trees, but especially the evergreens, the knots have more fuel value than the straight grained wood.

In the hickory and paper birch, the outer bark has high fuel value, prized for kindlings, otherwise the bark and sap would have less value than the heart. Slab wood as usually treated in the slab pile makes poor fuel, but worked up fresh and dried under cover, the bark still adhering, it makes a lively fire.

Wood grown in the open will give

more heat than the same variety grown in the forest, and up to full maturity wood improves as a heat producer, but later it diminishes as it does in strength and elasticity. The increase of pitch or turpentine in old trees gives them a fuel value far above that of the soft pine or immature growth.

A few observations on heat may appropriately follow: The most vitalizing heat is that of the sun in its direct rays; next is the radiant heat from burning wood or coal. The shepherd and the poultryman know that the direct rays of the sun have a vivifying effect upon the young lamb or chicken, surpassing that derived from any other source, excepting perhaps that from the body of the mother. The heat radiated from a close stove or steam, or hot water pipes may warm the body, but it seems to lack something that is conveyed by the sun's rays.

An open fire is company, with its brisk flame, and lively crackle demanding frequent attention, ungrudging bestowed by any one who accepts its companionship. It whiles away the idle hour between daylight and dark, called "candle-lighting" in the old times, when the blazing hearth bore the backlog and fore stick with high piled lighter wood; with an ample bed of red-hot ashes and coals, fit to receive chestnuts or potatoes, to season them while you wait with the peculiar flavor that those embers alone bestow.

The open fire is always drawing the family together with an unconscious force that no radiator or furnace possesses. It gives a silent lesson in good behavior, though often enforced in words, "Don't go before the fire," "Don't stand before the fire" (that is, before some other person). This is a lesson in unselfishness that is the foundation of all good manners. An old friend standing with me before a blazing fire, recently said, "An open fire is better than a minister in a family any time."

One of the great pleasures of the open fire is in watching the decaying

embers as the white ash encircles the burning stick, or the decaying coal, still retaining its size and form to the last. There is a great difference in wood in this respect, and on familiar acquaintance it becomes companionship, so that it is hard to conceive of loneliness in the presence of a lively fire, with a store of wood to replenish it.

The weight of opinion is largely in favor of dry wood, and in most varieties this is true, yet there are some hard facts in favor of some kinds of green wood, or conditions of the fire, that cannot be disputed.

Men who run engines for sawing lumber use the green slabs for fuel, and as soon as the fire is well started, do not hesitate to feed in the green slabs covered with snow and ice, claiming that such make the hottest fire.

In the olden times, with their big fire places, green hickory brush was highly prized for fuel; piled high in the old fire place, it made a roaring fire, stronger and more durable than dry brush. So green hickory wood has the preference to-day in many cases. Is there not a highly inflammable volatile oil in the hickory bark while green, which is lost in drying? So with the black birch. What boy would expect to find in the dry birch bark that delicate aroma and flavor which he finds in the green bark? That volatile oil is all gone then, and the farmer says birch burns the best.

Where else do we find the odor of woods and fields, the odor of spring in more sublimated form than when the bursting buds of the birch unite with the fragrance of the wild grape in a perfume unsurpassed by the odors of Araby?

Now the old farmer who has watched on his hearthstone the burning of different kinds of woods, as well as the collier who annually burns his thousands of bushels of charcoal, have some notions about these things that do not exactly harmonize with the claims of the scientist in his laboratory, and it belongs to the latter to

investigate and explain the apparent discrepancies that exist. The old farmer, as he covers up the half burnt brands with the burning embers or reinforces the bed with a stick of hard wood, almost as sure of fire in the morning as he is of sunrise, is an experimenter in a practical way, and his conclusions are worthy of consideration. The housemother, too, sometimes takes up this job, if the husband lacks in force and ingenuity, and becomes a true vestal to keep the fire

alive on the family altar. Such a one was the good wife who, when the old curmudgeon tested her temper by bringing all crooked and knotted wood for the kitchen fire; as deftly arranged it about her pots and kettles and the flames wrapped around them, she called his attention to how nicely they fitted their purpose, and pleased her. She was a true philosopher, upon whose hearthstone the fire would never smoke, grow dim, or expire.

USES OF INFERIOR WOODS

The Bureau of Forestry Demonstrates the Value of Woods Now Generally Considered Inferior

WHEN there was an abundant supply of the best quality of timber it was the habit of lumbermen to neglect all but the best species. For instance, in Indiana and Ohio the white oak trees were cut and the red oaks were left. In the South only a few years ago the gum, which is now of considerable commercial importance, was left to rot in the woods. On the Pacific coast the western hemlock was not considered worth transporting from the forest to the mill. In consequence the supply of high class timbers has been seriously depleted, and the character of the forest has been changed by the reproduction of the inferior species which were left in possession; while the lumberman has had to extend his operations over a large area in order to secure the necessary amount of timber. If these inferior species can be cut and marketed at a profit, it will be possible in the future to lumber with far less detriment to the forest, and at the same time the available supply of timber will be greatly increased.

The current unfavorable opinions concerning these so-called inferior species are largely matters of tradition, which investigation proves was

unwarranted. Indeed, in some cases, lumber such as gum and sap pine is exported from this country and held in high esteem abroad. Our engineers and architects, as a rule, consider sapwood weaker and much less fit for structural use than heartwood. Of course in the matter of durability of unpreserved timber under severe conditions of exposure, there is no question but that heartwood is very much to be preferred to sapwood. But for use indoors sapwood timbers are abundantly strong. Carriage manufacturers know that the strongest and most resilient wood for spokes, shafts, etc., is rapid grown sapling hickory. It has lately been discovered that fast grown second growth red oak, so far as strength is concerned, is fully equal to white oak. Much work remains to be done to bring out the facts underlying the practicability of a more extensive use of inferior timbers, and to disseminate information as to the relative advantages of first and second growth timbers and the value of such woods as western hemlock and loblolly pine, which are of increasing importance in the national supply of structural timber. The timber tests which the Bureau of Forestry is making are bringing the facts concerning

these matters before the users of timber.

The introduction of western hemlock to the market as a building material has met with many obstacles. The hemlock of the East is far inferior to the Western species as a building wood, and the prejudice existing against the Eastern species is unjustly extended to that of the West. The latter is a hard, straight, and even-grained wood, nearly white in color. It does not split readily, and is light and tough. These characteristics peculiarly fit it for manufacture into boxes. It is also a superior wood for all inside finishing, as it takes a high polish and has excellent wearing qualities. It can be rapidly kiln dried at high temperature without injury. Mechanical tests have shown it to possess about 70 per cent. of the strength of red fir and to be suited for all except the heaviest structural demands. Large quantities of this timber are now sold under other names than its own. There is no just cause for the prejudice which necessitates this deception, and Western hemlock should be handled under its right name.

Another tree which has been discriminated against is the loblolly pine. This is a tree of a wide range of distribution, and Bureau tests have shown that, under proper conditions of growth, it can furnish wood of great structural merit. It, too, is sold under fictitious names, when it should be sold on its merits. The principal objection to it is that it is usually sapwood and decays rapidly when exposed. But it is of open grain and

can be very successfully treated with preservatives, which should entirely eliminate this objection. Many of the so-called inferior timbers can be more thoroughly and successfully treated with preservatives than can the more solid timbers. Happily, this is in a marked degree the case with the abundant loblolly pine, and this tree is certain to come into general and appreciated use.

Another phase of this work is in connection with the packing box industry. Very few people appreciate the amount of lumber that goes into the manufacture of packing boxes. Formerly the size of boxes for different purposes, was based on the strength of white pine, which used to be the standard material employed. With the scarcity of white pine and its increased price, gum, cottonwood, loblolly pine, and other woods have come into use for boxes. In many cases these woods are much heavier than white pine, so that there is an added expense for freight because of the extra weight of the boxes. It becomes, then, an important matter to ascertain to what extent the thickness of boxboards commonly used can be reduced without lessening the strength of the box below the necessary requirement. The Bureau of Forestry, in co-operation with the North Carolina Pine Association, is about to take up this problem, and by actual experiment with boxes of different sizes and of various kinds of lumber to determine the extent to which the prevailing thicknesses of boards can be diminished.



TIMBER CUTTING IN MINNESOTA

The Work of Logging the Pine Trees in the Minnesota National Forest Reserve

WHEN completely established the Minnesota National Forest Reserve will contain about 225,000 acres. Of this area 105,000 acres have already been selected by the Government. Under the terms of the Morris law 95 per cent. of the pine timber thereon must be cut. This pine has been sold and the work of cutting was actively prosecuted last year. Nine logging camps were established, and the cutting began early in August. Two camps, which worked under a system of summer railroad logging, shut down for the season in November. The other seven camps, in which winter logging is being done, are still running.

The most interesting of the several operations, from a forester's stand-

point, was on sections 15, 16, 17, and 21 of township 145, R. 30. Section 16 was estimated to have the heaviest stand of timber in the former Indian Reservation. The very dense growth made it especially difficult to carry out with the best results the law requiring 5 per cent. of the timber to be left standing for reseedling or reforesting the land. When trees grow so close together that, after felling, the ground is almost completely hidden by their trunks, it is no easy matter to select single trees or small groups of trees so situated that their neighbors can be felled without injuring them. This was, however, successfully done.

The first work undertaken in the four sections mentioned, after locating



Pure Stand of Sapling Norway Pine in the Minnesota National Forest Reserve.

the two summer camps, was opening up and grading the roadbeds for the logging railroads. These roadbeds were cut through the heaviest stands of timber, and it is noteworthy that they required the cutting down of a strip of forest considerably narrower than a wagon road would have involved. From 785 acres of these four sections there were cut between August 8 and November 19 some 16,311,785 board feet of white and Norway

injury to the 5 per cent. of seed trees reserved. The area covered by the fires by which the brush and debris were destroyed was only about 7 per cent. of the cut-over land.

The contractors running the seven winter camps are also doing their cutting, hauling, and brush burning under the inspection of the Bureau of Forestry. Each of these camps operated over a larger area this season than did the two camps already men-



Reproduction of Norway Pine on an Old Burnt-Over District in the Minnesota National Forest Reserve.

pine. From all except 100 acres of this area the brush and debris smaller than 8 inches in diameter were cleared and built into compact piles as the logging progressed. These piles were burned between October 28 and December 23. The brush and debris on the remaining 100 acres were piled and will be burned at a suitable time in the spring. So carefully was the burning done that even in and around section 16 it was completed without

tioned. The timber purchasers have until July, 1908, to finish the cutting and removal of the timber from the sections already sold. Although the regulations for conservative lumbering were new to the lumbermen, they have been applied effectively. Not only have the relations between the Bureau officials in charge of the work and the loggers been entirely friendly, but a radical change in the attitude of the lumber interests of this

region towards forestry has taken place, as the result of a better understanding of its methods and its purposes.

An important result of the past season's work was the practical demonstration that it is most effective and most economical to pile and burn brush and debris, so far as practicable, as fast as the logging proceeds. When the burning can not be immediately done, the brush should be kept cleaned up and compactly piled close behind the logging. It can then be burned at a time when there is no danger of the fire spreading or getting beyond control.

In Minnesota, 1904 was a good seed year for both white and Norway pine.

Moreover, in many places, in addition to the 5 per cent. of seed trees reserved, there remains after the cutting and brush burning a good stand of young pine too small to be cut, which will now take on more rapid growth. Thus reforestation may be said to have already begun.

The second and final selection of lands to constitute the Minnesota National Forest Reserve will be made as soon as all Indian allotments have been completed, the flowage lines of the War Department's reservoirs in this locality have been definitely fixed, and the question of the status of the lands selected as swamp lands, which inure to the State of Minnesota under the Federal law, has been definitely settled.

RECENT PUBLICATIONS

English Estate Forestry. By A. C. FORBES. Pp. 332. Illustrated. (Edwin Arnold, London.) Longmans, Green & Co., American agents, New York.

This handsome volume is from the pen of a well-known English forester. He describes the beginnings of English forestry, its present condition and its future prospects. There are highly instructive chapters on the most profitable English timber trees and their silvicultural treatment; also on planting and regeneration, thinning and pruning. Landscape forestry naturally comes in for careful discussion, and a suggestive chapter on park timber and avenues adds much value to the volume. A number of excellent photogravures heighten the beauty of a well-printed book. It is a book that, although describing English estate forestry, should be of considerable value to Americans in these days of rising interest in country life and homes.

Musk Ox, Bison, Sheep, and Goat. By CASPAR WHITNEY and others. American Sportsman's Library. Illustrated. Price \$2. The Macmillan Company, New York.

This is the latest volume in the excellent series of sporting books being issued under the general title of the American Sportsman's Library, with the able editorship of Mr. Caspar Whitney. Mr. Whitney, along with George Bird Grinnell and Owen Wister, have written the various chapters that go to make up the volume. It records in an accurate and interesting manner the

characteristics, range, habits, etc., of these rapidly disappearing animals. These names are sufficient guarantee of the book's accuracy, and should give it a place in the library of all sportsmen.

With the Trees. By MAUD GOING. Pp. 335. Illustrated. Price \$1.00. The Baker and Taylor Co., New York.

Miss Going, author of "With the Wild Flowers" and "Field, Forest and Wayside," in her latest book, "With the Trees," has produced a pleasing and instructive untechnical volume for the general reader. With its bright, entertaining style and its many apropos illustrations, it should do much to stimulate a greater love for and interest in our forests.

Mineral Resources of the United States; Calendar Year 1903. By DAVID T. DAY, Chief of Division of Mining and Mineral Resources, U. S. Geological Survey. Pp. 1204. Washington. Government Printing Office, 1904.

Besides mining and mineral statistical matter for the calendar year 1903, there is contained in this volume considerable descriptive and technical matter, obtained while the statistical canvass was in progress. The report should be very valuable to the miner and geologist, and the tabulated matter is of interest to the layman. This is the twentieth annual report published by the Mining Division.

Twenty-first Annual Report of the Agricultural Experiment Station of the University of Wisconsin. For the year ending June 30, 1904. Pp. 392. Illustrated with numerous half tones. Madison, Democrat Printing Co., 1904.

To the annual report of the director of the Agricultural Station is appended nearly a score of articles dealing with various phases of agriculture, and designed to promulgate among Wisconsin farmers generally the principles of practical agriculture as founded on scientific facts. With the development of agriculture that has come during the last quarter of a century, its practice is gradually assuming a semi-scientific character, and the publication of such a volume as this, with its many valuable articles, gives the up-to-date farmer the facts and figures in a convincing manner.

Report on the Condition of Treated Timbers Laid in Texas, February, 1902. Bulletin No. 51, Bureau of Forestry. By HERMAN VON SCHRENK. Pp. 45. Illustrated with 6 half tones. Washington, Government Printing Office, 1904.

This is a report on the present condition of railroad tie timbers, variously treated with certain preservatives which were laid on the Beaumont division of the Gulf, Colorado and Santa Fe Railway, and which have been in use during a period approximating eighteen months. Each tie was numbered and a record kept of the particular preservative process used, duration of same and locality of treating plant, and thirteen kinds of wood were made use of. The report gives general deductions in the form of reading matter, and specifies in tabulated form the result to each particular tie laid.

Report Upon the Administration of the Public Works Department in Egypt for 1903. By SIR WILLIAM GARSTIN, G. C. M. G. Pp. 430. Illustrated with numerous maps and diagrams. Cairo; National Printing Department, 1904.

Of most interest to American readers are those portions of this volume which are devoted to irrigation, although the entire publication has many interesting reports and articles which would attract the general reader. The figures given illustrating the increase in value of land in Middle Egypt, ascribed to the influence of the Asyut Barrage, the Aswan Dam and other irrigation works along the Nile, are convincing; eloquent of the splendid services rendered Egypt by the Public Works Ministry.

Federal and State Forest Laws. Bulletin No. 57, Bureau of Forestry. Compiled by GEORGE W. WOODRUFF, A.B., LL.B. Pp. 259. Washington, Government Printing Office, 1904.

As the title indicates, this volume is a compilation of the various Federal and State statutes bearing on forestry, and Mr. Woodruff has arranged them by States, in alphabetical order, under the heads of Constitutional Provisions; Administration and

Use; Trespass on Private Lands and Trespass on Public Lands; Forest Fires in General and Those Caused by Railroads; Bounties, Rebates and Exemptions; Investigation, Education and Public Observance. There is also included an appendix, with a table with information concerning present forest reserves, timber reservations, national parks, etc. The Bulletin is especially intended to help the Federal and State officials who deal with forest questions, as well as the layman who wishes information concerning forest legislation. It is one of the most helpful publications that the Bureau of Forestry has yet issued.

Methods Used for Controlling and Reclaiming Sand-dunes. Bulletin No. 57. Bureau of Plant Industry. By A. S. HITCHCOCK. Pp. 36. Illustrated with 9 half-tone plates and 9 text figures. Washington, Government Printing Office, 1904.

On the Atlantic and Pacific coasts, on the shores of the Great Lakes, and at numerous places inland, there are areas of sandy land, for the most part originally covered by vegetation, but now denuded of plant-growth through the too-prevalent American idea of utilizing everything in sight, without thought for the future. Sand-dunes have in many places proved a positive menace, and Mr. Hitchcock gives an outline of the methods followed in the Netherlands, Denmark, Germany and France.

Cost of Pumping for Irrigation. Bulletin No. 49, University of Arizona Experiment Station. By SHERMAN M. WOODWARD. Pp. 12. Tucson, November 28, 1904.

A very interesting little pamphlet, which describes in a simple manner the construction of home irrigation systems, and details cost of the same.

Irrigation in the United States: 1902. Bulletin No. 16, Bureau of the Census. Pp. 92. Washington, Government Printing Office, 1904.

This volume contains very valuable statistical matter regarding irrigation in this country, which is amplified upon and made more interesting by historical and descriptive reading matter on the subject.

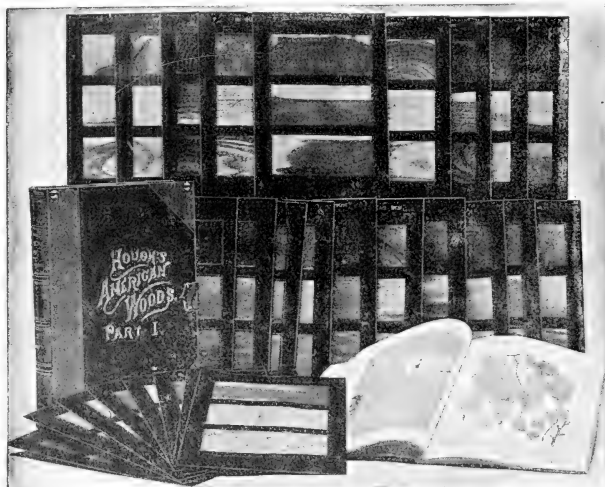
How Plant Life is Distributed in Canada and Why. By A. T. DRUMMOND. Reprint. Pp. 16.

In this little pamphlet Mr. Drummond discusses in an interesting and popular way the causes which influence distribution of plant growth in Canada and summarizes briefly the general aspects of vegetation in the various groups readily distinguishable, noted as the Canadian, Forest, Maritime, Eastern Coast, Erie, St. Lawrence, Boreal, Ontario, Prairie, Western Plains, Rocky Mountain, British Columbia, Southern British Columbia, Cascade, Arctic, and European. In estimating the age of Canadian flora, Mr. Drummond says there are certain species which have existed since the early Eocene Era.

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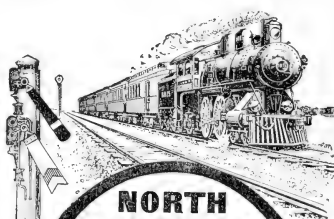
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Forestry and Irrigation

H. M. SUTER, Editor

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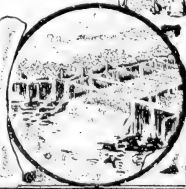
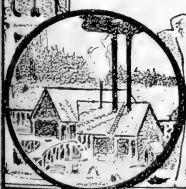
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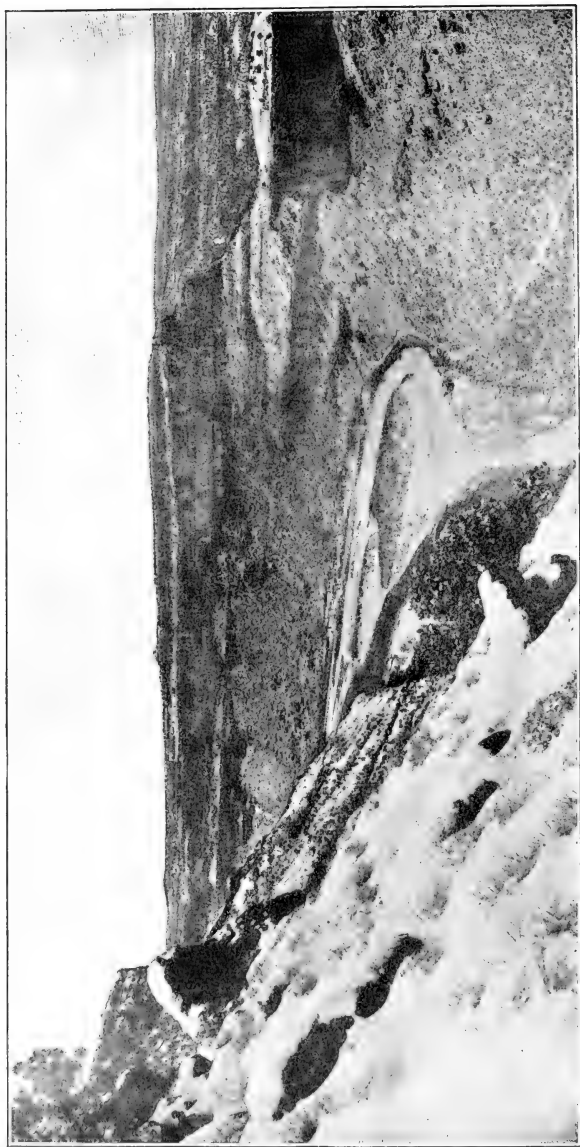
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Panoramic View of Grand River Canyon, Colorado.

Forestry and Irrigation.

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NEWS AND NOTES

National Forest Legislation.

In spite of a short session and a calendar crowded with important measures requiring prompt consideration, Congress found time to enact some important forest legislation at the session recently closed. The most important of the several measures passed and a decided forward step in forest matters was the bill which transferred the administration of the national forest reserves from the Department of the Interior to the Department of Agriculture, notice of which was made in the February number of FORESTRY AND IRRIGATION. In this connection it is well to state that beginning July 1st, the Bureau of Forestry will be known as the "Forest Service." The change of name being provided for in the agricultural appropriation bill.

A matter of great importance was the repeal of the lieu selection law, which now makes it impossible for persons holding lands within forest reserves to exchange them for equal areas elsewhere in the public domain as heretofore.

In the agricultural appropriation bill a provision of much importance to various communities in the West provides that: "The Secretary of Agriculture may, in his discretion, permit timber and other forest products to be cut and removed from the forest reserves, except in the Black Hills Forest Reserve, in South Dakota, and the forest reserves in Idaho, to be exported from the State, Territory, or District of Alaska, in which said reserves are respectively situated." This makes it possible for lumbering to be engaged in and will greatly help the prosperity of the regions surrounding the reserves. A new departure in

creating forest reserves is contained in a provision in the Indian Appropriation bill, which provides that the President may set aside by proclamation, such part as he sees fit of the Uintah Indian Reservation in Utah as a national forest reserve. Heretofore the President has been empowered to set aside forest reserves only from lands actually a part of the public domain. The general deficiency appropriation bill includes a deficiency item of \$50,000 for the care of forest reserves. A separate act authorizes the Secretary of the Interior to use earth, stone, and timber on the public lands and forest reserves, in the construction of works under the National Reclamation Act. Still another bill excludes from the Yosemite National Park certain lands, and attaches the same to the Sierra Forest Reserve. A further act gives all persons employed in the forest reserve and national park services in the United States, authority to make arrests for the violation of regulations of the forest reserves and national parks. A bill was also passed for the protection of wild animals and birds in the Wichita Forest Reserve, in Oklahoma.

Congress and the Public Lands.

Elsewhere in this issue of FORESTRY AND IRRIGATION is printed the full text of the second partial report of the Public Lands Commission. The public lands question is of such vital importance and the report deals with it so clearly in a small space that we feel it should be in the hands of every reader.

One of the most far reaching pieces of legislation of this latest session of Congress was the repeal of the lieu selection law, thus preventing the location in the future of all forest reserve

scrip, so-called, that is, repealing the right of a man or a corporation owning land within a forest reserve to relinquish it to the Government and select "in lieu thereof" an equal area of any other unreserved non-mineral public lands.

The repeal of this lieu land law is the first recognition by Congress of the wise recommendations of the President and his Public Lands Commission. There are three other specific reform recommendations of the President and the Commission, and these will come up for action by Congress at its next session.

This is a decided step forward in land law reform and does away with one of the most notorious and scandalous forms of fraud and graft under the Federal land laws. Under this law enormous losses have been suffered by the Government, the right to select these lieu lands having been transferable and resulting in the relinquishment during the past few years of several million acres of comparatively worthless railroad-grant and other lands included within forest reserves, and the selection in their place of equal areas of the most valuable timber lands in the Northwest.

Denuded slopes not worth 50 cents an acre, or bare mountain sides; acquired under other land laws at a nominal figure simply for the purpose of exchange, have been relinquished and lieu selections made, often worth according to the highest authorities, \$20 and even \$100 an acre. By these transactions the country has lost in the last few years millions of dollars. By the action of Congress this form of graft is now at an end.

Defeat of Square Mile Homesteads.

Another point wherein Congress followed the recommendations of the Public Lands Commission was in the refusal of the Senate to enact the 640-acre homestead laws for Colorado and South Dakota; although the House did its best to secure this square mile homestead legislation. In defiance of the strong adverse reports of the

Commissioner of the General Land Office, the Secretary of the Interior, the Public Lands Commission, along with the special message from the President to Congress endorsing the Commission's recommendation against these bills, and of the strong protest of Chairman Lacey, of the House Public Lands Committee, the House of Representatives passed these measures by a vote of nearly three to one.

This proposed legislation was considered especially unwise just at this time when the Department of Agriculture is every year bringing into the possibilities of profitable cultivation millions of acres of the semi-arid lands, where it was proposed to apply these laws, through the introduction from abroad of drought resistant plants and desert species of grain and fodder, and by new and improved methods for farming dry lands. Moreover, the Commission has worked out a plan of range control and grazing permits which gives the real settler all asked for under the 640-acre measures and yet avoids the danger of the absorption of the land into large holdings, but allows ample time and scope for the "dry farming" reclamation work of the Department of Agriculture.

"All in all," remarked a prominent advocate of both irrigation and forestry, a man high in official life, "very much indeed has been accomplished in this Congress, the result of previous hard work. Now we have this report of the President's Public Lands Commission, outlining a comprehensive policy for the treatment of the entire irrigation, forestry, and public land questions, and we can all stand together on this report, and I believe get its provisions through the next Congress. The time is ripe, the country is awake."

The things to be done, mentioned in the report, are the repeal of the notorious timber and stone act with the substitution of a method of stumpage sale by the Government, the public timber lands to remain in the Government, thus insuring reforestation and

protection to the water supply; the very radical amendment of the fraudulent desert land law and the commutation clause of the homestead law, requiring in both cases actual residence of the settler and insuring real home-making. All three of these laws as stated in the report, have been, are, and will be, so long as they remain on the statute book, instruments of fraud, perjury, and great loss to the nation. They stand as a continual menace not only to a broad forestry policy, but to the very existence of the national irrigation idea and are fast bringing about a condition of absolute land monopoly in the West.

Supporting the Reclamation Service. Several bills desired by the Reclamation Service to more fully carry out the provisions of the Reclamation Act, were considered and readily passed by Congress. These include the bill to allow the proceeds from the sales of the vast amount of partly used supplies, at the end of each season, to go back into the "reclamation fund," instead of into the treasury, thus keeping the fund intact and operating as an incentive to the engineers to take care of their property and realize the most out of it.

A Lightning Change. According to the newspapers, a German paper manufacturer at Esenthal has just made an experiment to see how rapidly it is possible to transform a tree into a newspaper. As the story goes, three trees in the neighborhood of his factory were cut down at 7:35 in the morning. They were instantly barked and pulped, and the first roll of paper was ready at 9:34. It was lifted into an automobile and conveyed to the press-room of the nearest daily paper. The paper being already set, the printing began at once, and by 10 o'clock precisely the journal was on sale in the streets. The entire process of transformation had taken exactly 2 hours and 25 minutes. While it may be doubted that the above-described operation took only about

two and a half hours, at the same time it serves to illustrate one of the numerous ways of turning trees into usable form with wonderful rapidity.

Forestry in Illinois.

The Illinois Federated Women's Clubs—a federation of 268 clubs with a membership of over 25,000—has taken up with serious earnestness the practical question of scientific forestry in Illinois, and with that end in view has prepared and had introduced in the Illinois Assembly three forestry bills. One of these proposed laws provides for a chair of forestry in the State University of Illinois, another for the organization and maintenance of a State forestry commission, appointed by the Governor from selections made by the Farmers' Institute, the Illinois Nurserymen's Association, the State Agricultural Society, the State Horticultural Society, and the chair of Forestry of the State University. The third bill provides for the purchase of a pine tract in Ogle county.

Forest Law for California.

The legislature of California has passed the act introduced by Senator Anderson to provide for "the regulation of fires on, and the protection and management of, public and private forest lands in the State of California, creating a State Board of Forestry * * * and creating a forestry fund and appropriating the moneys in said fund, and defining and providing for the punishment of certain offenses for violations of the provisions of this act, and making an appropriation therefor." The State Board of Forestry is to consist of the Governor, Secretary of State, Attorney-General, and State Forester, which latter position has been created, with a salary of \$2,400. The supervision and care of the State forest reserves and parks is in charge of the board, and the State Forester is empowered to lend his assistance in any coöperative work of the State with counties, towns, corporations, and individuals, and directed



Link River and gravity irrigation ditch, Nimitz County, Oregon.
(Courtesy Nimitz and Irrigation Dept.)

to prepare and distribute abstracts of the forest laws, and appoint fire wardens for as many districts as he may see fit to divide the State. Penalties are prescribed for the violation of the provisions of the act, and the district attorneys directed to prosecute vigorously all such violations. The penalty for wilfully, maliciously and negligently setting forest fires is put at not less than \$50, or more than \$1,000. An appliance to prevent the escape of sparks is required on all engines and boilers operating in or near forests, brush, or grass land, and the State Forester is directed to see that country roads in various counties are cleared of inflammable material. An appropriation of \$17,600 was made for carrying out the provisions of this act, and a section provides that the moneys received as penalties of violations shall be paid into the treasury as a State forestry fund.

Yale Summer School.

Formal announcement has been made of the fifth annual session of the Yale Summer School of Forestry, which will open July 5, 1905, and close August 17th. The course is designed for students who are considering forestry as a profession, for young men about to enter the lumber business, for teachers of botany and nature study, for forest rangers, for woodland owners, and for all other persons desiring to spend a summer out of doors and to obtain a general knowledge of forestry. The course is of great assistance to those who afterwards enter an advanced forest school. Full information can be had by addressing Professor Henry S. Graves, New Haven, Conn.

Forestry at University of Nebraska.

The Department of Forestry in the University of Nebraska reports good progress for the present year. Plans were recently completed whereby forestry is given a permanent place in the curriculum of the School of Agriculture, and a course of several lectures on farm forestry is being giv-

en there this semester. In all, some sixty students have been brought under instruction in forestry this year. Of this number about twenty are preparing for the profession. Two men expect to graduate from the forestry course in June.

So far as time would permit, the department has been represented in the farmers' institute work in the State, and as a result the number of applications for assistance in forest planting and in managing woodlots is increasing. A plan for planting jack pine in the sand hills was recently prepared, and fifteen copies were mailed to applicants in February.

At the beginning of the school year, the students of the department organized the University of Nebraska Forest Club. This organization meets every two weeks.

Reclamation Service Notes.

Mr. Charles H. Paul, of Philadelphia, has received an appointment as engineer in the U. S. Reclamation Service, and has been assigned to duty in connection with the Ft. Buford project, South Dakota. Mr. Paul graduated from the Massachusetts Institute of Technology with the degree of C. E., and was engaged for several years with the State Board of Health, and the Metropolitan Water Board, of Boston. Since 1900 he has been engaged on construction work in connection with filters and reservoirs in Philadelphia.

Mr. James L. Lytel, irrigation engineer, who has been engaged for the past nine months at Montrose, Colo., in connection with the Uncompahgre Valley project, has received a permanent appointment under the Reclamation Service.

Mr. John L. Mann, of New Hampshire, has received an appointment as assistant engineer in the Reclamation Service. He has been assigned to duty under the Belle Fourche project, in South Dakota.

The following assignments have been made by Director Walcott, of the U. S. Geological Survey, in connection

with the work of the Reclamation Service in Montana:

Irwin B. Hosig, of Madison, Wisconsin, hydrographic aid; Charles E. Chipman, Ambridge, Penn., and John C. Clegghorn, Onawa, Iowa, engineering aids.

These men are appointed from the Civil Service list and will report to S. B. Robbins, engineer in charge of Sun River project, at Great Falls.

In continuance of an investigation of the irrigation project which is being made in the vicinity of Holbrook, Arizona, the chief engineer has ordered the establishment of gaging stations on the Little Colorado River above the mouth of the Puerco, in the vicinity of Woodruff, and below the mouth of the Puerco in the vicinity of Holbrook, and also of Clear Creek and Chevlon's Fork, which are tributaries of the Little Colorado.

Forest Reserve Personals. On March 1, Mr. A. Anderson, formerly Special Forest Superintendent of the Yellowstone Forest Reserve, was made Special Forest Inspector of that reserve.

Forest Inspector S. A. Barrett is temporarily in charge of the western division of the Santa Barbara Forest Reserve, in California.

Forest Ranger J. R. Bell has been placed in charge of the San Jacinto and Trabuco Canyon Reserves, in California, taking the place of former Forest Supervisor Bartlett, who has resigned.

Forest Ranger S. N. L. Ellis has been placed in charge of the Stanislaus and Lake Tahoe Forest Reserves, in California, taking the place of Forest Supervisor Grant I. Taggart.

Forest Ranger L. F. Kneipp has been placed in charge of the Pecos River Forest Reserve, taking the place of former Forest Supervisor T. B. Hanna, deceased.

The office of Forest Superintendent for the Northern Division of the Sierra Forest Reserve, in California, formerly held by Forest Superintendent

C. S. Newhall, was abolished on March 1, 1905.

The office of Forest Superintendent for the Southern California Forest Reserves, formerly held by Colonel B. F. Allen, was abolished on February 1, 1905.

Early Experiment in Forestry.

An interesting example of the profit in conservative forest management in this country is furnished by Dr. S. B. Caldwell, of Paducah, Ky., who has dealt in timberlands in the southwestern part of the State for fifty-eight years. "In 1847," says Dr. Caldwell, "I sold timber from a tract of land at \$1 an acre, the purchaser having the privilege of removing what he wanted and leaving what he did not want. He took the choice trees, but left a considerable amount standing. In 1870 I sold the timber from the same tract and got for it \$2 a tree. The purchaser removed an average of three trees per acre. In 1884 I sold the timber from the same tract for the third time, and got for it as much as I had received at the second sale."

Dr. Caldwell's experience in the woods taught him long ago the wisdom of conservative forest management. Thirty years ago, when he came into possession of a tract of about 700 acres near Paducah, he sold a quantity of the timber for wagon stock. At that time forestry in this country was virtually unknown. Dr. Caldwell, however, was sufficiently foresighted to allow no trees to be cut except those which he selected. He went about in the woods and picked out trees whose tops and general appearance showed they had passed their period of greatest vigor, and trees which interfered with promising young growth. His forest has been culled a number of times in the past thirty years, but so wisely has the cutting been done that to-day the land will average from 10,000 to 15,000 board feet per acre. This was an experiment in forestry which has amply justified itself, and shows how a

shrewd and far-sighted man may, even without technical advice, secure good returns from his woodland without impairing its productive value and while putting himself in position to profit by the steady rise which is taking place in timber values.

North Dakota Irrigation Code.

The legislature of North Dakota recently passed a comprehensive irrigation code which follows closely the provisions of the suggested State irrigation code drawn up last summer by Mr. Morris Bien, of the U. S. Reclamation Service. This is the first effective legislation on the subject in North Dakota, and will put irrigation investigations there upon a well established and permanent basis, so that it is now possible to secure the exclusive services of a competent man as State engineer. The first State engineer, Professor E. F. Chandler, who began that work last season and has been carrying it on in addition to his work as resident hydrographer for the U. S. Geological Survey and to his regular duties in the State University, now transfers the office to Mr. A. L. Fellows, of Denver, Colo., who has been for the past two years district engineer for Colorado of the U. S. Reclamation Service, and who under the new law is now appointed by Governor Sarles as State engineer of North Dakota.

Western Tree Planting.

The agents of the Bureau of Forestry detailed to investigate planted groves and natural timber in the eastern half of the two Dakotas and the western third of Minnesota have completed their field work. The results of their investigations will be embodied in a report which will be published as soon as the data collected can be tabulated and definite conclusions drawn.

Throughout the region investigated a good deal of tree planting has been done to meet the requirements of the Timber Culture Act or for protective purposes. Local benefits have been

gained by this planting, and a study of the results gives a good basis for suggestions looking towards still better results in the future. The species most generally tried are those which grow naturally in the river bottoms of the region, together with some which have been introduced from Europe. They are cottonwood, boxelder, green ash, silver maple, white willow, and white elm. These trees have some admirable qualities, but are in some respects unsuited to the region.

The ideal tree for planting on the prairie is one which is able to resist extremes of drought and temperature, is free from insect enemies, makes a rapid growth, and is at the same time valuable for both protective and commercial uses. Some of the conifers or evergreens have these characteristics in a high degree, and enough planting of certain species of pine, spruce, and larch has been done to prove their superiority. For future planting in this section the Bureau will probably recommend the substitution to a large extent of cone-bearing trees for some of the species which have been in common use.

In the past the timber value of trees was a secondary consideration. Trees were planted for their protective value and for ornament. But by a proper choice of trees a direct profit can also be reaped. A species which meets commercial requirements will, in most cases, answer all other demands. This additional commercial benefit in tree planting the Bureau will emphasize in its forthcoming report.

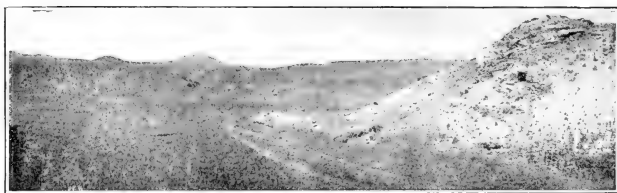
The region examined is prairie land, very fertile, and for the most part devoted to profitable farming. But the hot, dry winds from the southwest are very injurious in summer, while the crops are maturing; in the long winters the piercing cold winds from the northwest are a menace to livestock as well as a source of great discomfort. Hence windbreaks along the south, west, and north sides of farms, buildings, and inclosures contribute largely to the welfare of farm life. It

is of the first importance that the kinds of trees composing these windbreaks should be those which will most quickly reach the size demanded to furnish efficient protection, and at the same time permanently hold their ground and perform their office. In addition,

they should yield good commercial returns. The careful consideration which the Bureau has given to this side of the question should make its recommendations of great value to the farmers of the extensive region studied.



Scott's Basin, Washington, from head of Johnson Creek.



Reservoir Site, Scott's Basin, Washington.



Dam Site, Scott's Basin, Washington.



Fish Lake Reservoir Site, Washington.

FORESTRY IN INDIANA

BY

SAMUEL J. RECORD

Forest Assistant, Bureau of Forestry

INDIANA, though in area one of the smallest of the Western States, ranks among the foremost in wealth, resources, and advancement. Consistent with its progress in other lines is its present active interest in forestry—an endeavor to make amends for past extravagance and neglect. The study of its problems and experiments toward their solution should prove both interesting and instructive.

Topographically, the State may be considered a plane, with its lowest levels in the southwestern portions, where it has an elevation of about 300 feet above sea level. The highest region is found in the central and eastern part where the general elevation is between 900 and 1,300 feet above sea level. From this region the land slopes in every direction. The entire northern portion of the State is covered deeply with glacial drift, and therefore, differs materially in the character of its soil from other regions.

The drainage is through the St. Joseph to Lake Michigan, through the Kankakee to the Mississippi, through the Maumee to Lake Erie, and through the Wabash to the Ohio. By far the greater portion of the State is drained through the Wabash and Kankakee, while only the northeastern counties enter the lake drainage.

Along these streams are rich valleys, once thickly covered with the most valuable timber in the world. Fully 28,000 square miles covered with splendid oak, walnut, ash, tulip, cherry, maple, elm, hickory, beech and sycamore was once our heritage. Nowhere in America did there exist a more magnificent hardwood forest than that which clothed four-fifths of Indiana's area. Invaluable as such

timber would be to-day, it was then a hindrance and obstruction. It was a foe to progress and a terror to the early settler. The tide of emigration was on westward from New York, Virginia, and the Carolinas, and Indiana was passed by thousands seeking the prairies of the Western States.

Indiana's development began with the destruction of its magnificent forests. At first there was no market for the timber and the best was cut into rails, hewed into sills, or used for firewood. Regular logging bees were held and tree after tree was felled, their massive trunks rolled together and burned. The coming of the railroads introduced improved saw-mills and transported their products to ready markets, while up to this time the forests had been removed mostly in the interests of agriculture, the desire for revenue now entered as a new stimulus to forest destruction. A full appreciation of the conditions confronting the early pioneer reveals how naturally this policy of forest destruction was inaugurated. And now it is hardly to be expected that a people who have for three or four generations been so actively engaged in destroying the forest which obstructed their progress should busy themselves with the planting of tracts with a view of establishing other forests. The descendants have inherited the spirit of their fathers and have continued their work of clearing and destroying and wasting without due regard for changed conditions or thought for the future.

We are wont to condole this destruction and point with pride to our excellent farms, among the richest in the world, with their herds of cattle and stock of all kinds. But do we realize that there are in Indiana 13,-

000,000 acres—*more than half the State!*—of broken waste land suitable for tree growth but worthless for agriculture? That the total acreage of *good* timber comprises less than two per cent. of the total area of the State? And that fully 85 per cent. of the lumber used in our manufactories is brought in from other States?

Some of the disastrous effects of this immoderate deforestation are already being experienced. One of the most noticeable results has been the

ests many of the industries dependent upon them have disappeared. This represents a distinct loss to the State. Moreover, the injurious effects upon climate and health, and the productiveness of the fields, though not matters of common notice, are none the less actual, and will tend to increase. While these alone might be sufficient reasons to warrant State action, they will not serve to arouse private interest to the point of accomplishment. The tendency is to drift



View of the William Binford woods, the largest timber being oak and yellow poplar.
This is all virgin timber land.

disappearance of many springs, the consequent failure of domestic water supply and the variation in volume regularity of streams. Rivers which once were navigable for good sized boats are so no longer, and the irregularity of their flow has rendered them useless for water power. Deforestation has not been wholly responsible, however, for cultivation of open fields and the extensive underdraining of level areas has contributed very materially to these results.

With the passing of Indiana's for-

idly along because it requires less effort to adapt one's self to changing conditions than to try to prevent the change. Sentiment alone, unaided and unorganized, will avail little, but its existence is absolutely essential to the success of any forestry movement. Such sentiment born of existing conditions and fostered by the public press, by civic organizations, and by private individuals now seeks expression in the form of a rational forest policy for the State.

Of the three ways in which the State

can regulate forest matters, that is (1) by education and persuasion; (2) by restrictive measures or indirect control, and (3) by direct ownership and management, only the first seems applicable to conditions in Indiana. It is a splendid agricultural region where practically every acre of land is owned by actual farmers. No great rivers take their rise within our borders, although some quite important smaller rivers are fed from streams within the State. Great bodies of forest are un-

annual farm crops. With a little well-directed effort the farmer can employ such areas in the growing of timber for posts, fuel, and lumber. When rightly managed these waste lands become a profitable source of revenue and materially increase the value of the farm. When the farmer has once realized this fact and acted accordingly the whole forest question has been solved, and, best of all, the solution has been effected by the parties most directly concerned. For it is the farmer



Small white ash grove southwest of Crawfordsville, containing four or five acres of young ash trees in excellent condition.

necessary and could not be established without including valuable agricultural land. Although the total amount of waste and non-agricultural land is enormous, it exists in relatively small areas well distributed over the entire State. On nearly every farm there are portions suitable for tree cultivation. The broken lands along the Ohio and its tributaries, banks of streams, sides of ravines, steep hillsides, stony areas, knolls and ridges, offer places where forest trees would be more profitable than cultivation in

who is chiefly responsible for the present condition of our forests and upon him falls the burden of their restoration. Fortunately, he will be the first to derive benefit from his labor.

The adoption of restrictive measures or indirect control of private property by the State or Government would meet with much opposition. The policy of our Government is that of non-interference, and should not be changed except in cases of urgent necessity.

There still remains the most impor-

tant province of the State—that of stimulating proper action by education and persuasive means. This could be accomplished, (1) by creating a favorable sentiment among the people; (2) by demonstrating the practicability of forestry; (3) by aiding and directing the farmer's efforts.

The existence of a public sentiment favorable to forestry has been previously remarked, but it remains for

more valuable for other purposes; and upon the ability of the forester: (1) to assure adequate protection to the forest at small expense; (2) to produce a merchantable product within a reasonable time. From these it is evident that the best conditions for the practice of economic forest management are found in just such localities as we are now considering. Here tree growth is rapid, the market is



Young Walnut (*Juglans nigra*) on the farm of J. N. Beach, near Linden. The walnuts were scattered thickly in a potato patch and cultivated in and then allowed to care for themselves. The trees are straight and well formed, about thirty feet high, and three to six inches in diameter. This farm is in a prairie region and the walnut grove serves as an excellent wind break for the house. The grove was planted in 1882.

the State to further stimulate and direct it. It should not prove difficult to demonstrate the practicability of forestry in a region so favorable to it as Indiana. Ideal application of forestry principles to the management of supply forests depends upon the existence of: (1) favorable conditions for forest growth; (2) a ready market for both the better and inferior kinds of material produced; (3) soils not

unexcelled, transportation facilities are of the best and desirable land is available. The problem appears simple enough. How is it being solved?

The first attempt at forest legislation was in 1890, when the General Assembly of Indiana enacted a forest reservation law, whereby upon any tracts of land a portion, not to exceed one-eighth of the total area, could be selected as a permanent forest reser-

vation and would be appraised for taxation at one dollar per acre. The land to be thus exempted must contain at least one hundred and seventy trees per acre, either naturally or artificially propagated, and must not be pastured until the trees have attained a diameter of four inches. The act makes further attempt at specifications which are in themselves devoid of tangible principle. The law has in it much that is

effort in the creating of a forest policy. The exemption act of 1899 was given a better trial, but has not proved successful. Of the many exemptions made, fully 99 per cent. were found upon examination to have failed to meet the requirements of the law and were rejected. From this it can be inferred either that there exists a dearth of eligible woodlands or that the owners of such were either igno-



View of a ravine near Crawfordsville, showing the work of trees in holding the soil from washing. The steep slopes and shallow soil are capable of growing good timber.

good, but the results of its operation demonstrated the difficult of accomplishing much without provision for education. No attempt was made to direct the owner in his efforts to bring his depleted forests to the standard where exemption could be secured and consequently the total acreage was not increased.

The following year a State Board of Forestry was created and established which materially increased the public interest in forest matters and marked the beginning of organized

rant of the law or did not regard the financial consideration a sufficient inducement. In many instances the county auditors and assessors have used their influence against the law's execution. The Board is now urging that the act be repealed.

The next important step was the enactment of a law approved March 3, 1903, entitled "An act to provide for the purchase of land by the State Board of Forestry for the purpose of a State forest reservation, laboratory of forestry demonstration, and State

nurseries, and to provide for the management and location of the same." The purchase of two thousand acres of land at a cost not to exceed eight dollars per acre, was authorized and the sum of one dollar and fifty cents annually thereafter was to be allowed to defray the expenses of management and labor. The land was purchased in Clarke county, twenty miles north of Jeffersonville, and measures were at once taken to carry out the provisions of the law. Various experiments are to be conducted to demonstrate methods of silviculture, tree planting, and forest management. Most important of all is the establishment of a State nursery wherein seedlings will be raised for free distribution to the farmers of the State. Since there are no forest tree nurseries in Indiana this action of the State will not interfere with any private enterprise.

This distribution of plant material, though not a new idea, has never been undertaken by any other State. Formerly the chief of the Division of For-

estry was enjoined to make such distribution, and did so long enough to be convinced "that the size of the country and the number of people with equal rights to this bounty, as well as the practical difficulties in handling such plant material, which must necessarily vary in kind according to locality, forbid the practice, or, at least, do not promise adequate results, except possibly in planting a few shade trees."

The method, however, has proved satisfactory in European countries where the State not only distributes material free or at cost of production, but also supervises the planting of it. the distribution, however, is made not to private owners, but to associations and communities. In this country the success of the undertaking depends upon the enthusiastic coöperation of the land owners and requires that the distribution of plant material be done systematically and intelligently with judicious supervision.

THE KREMMLING RESERVOIR SITE

Situated in Colorado--Largest Yet Discovered;
Great Reclamation and Power Possibilities

BY

A. L. FELLOWS

District Engineer, United States Reclamation Service

IMMENSE reservoir sites are being discovered in many parts of the arid west. The largest of all thus far known is that generally designated as the Kremmling site, situated in Grand County, which is near the center of the northern half of the state and comprises the greater portion of the upper drainage basin of Grand River, with the exception of that contained in Summit County drained by Blue River, an important tributary of the Grand. The two counties together comprise an area of about 2,790 square

miles, covering and surrounding a great mountain park generally known as Middle Park. This vast area is, to all practical intents and purposes, a great basin, the altitude of the meadows along the river bottom being about 7,100 feet above sea level. The sides are composed of great mountain ranges, among which are the Park or Gore Range on the west and southwest, and the Continental Divide of the Rocky Mountains on the north, east and south, the peaks ascending to elevations of 14,000 feet or more.

Many of the most interesting features of the state of Colorado are contained within this basin. Mountain lakes of deepest blue surrounded by spruce and pine forests of a rich green and abounding in game; great rivers clear as crystal along their upper

es at the bottom of the park, they flow sluggishly, turning and twisting like great serpents until they meet and combine in a mighty torrent which has forced its way through the Gore Range, which forms the western boundary of the park.



No. 1. Kremmling Reservoir Site, from point about 500 feet high nearly over dam site.



No. 2. Showing view from point "B" looking up Blue River over the village of Kremmling.

courses, flowing from the high mountain peaks in which are the springs that form their sources, hurrying along almost with the speed of a railway train, but lower down in more level country becoming less and less turbulent until, along the lower reach-

It is evident that in days long since past there was a great lake covering the lower part of this basin, and that an outlet has been gradually eroded through solid granite, deposits of sediment filling the bottom of the basin at the same time until the bottom of

the outlet is now on the same level as the meadows which now constitute the bottom of the old lake bed. So level is this tract that during the spring rise of the Grand River and its tributaries, the waters are backed up from the gorge, forming a great lake miles in length and in places from one to two miles in width.

Great interests depend upon the feasibility of the plans for the construction of this reservoir. There are hundreds of thousands of acres of the richest land along the Colorado River in California and Arizona, for which

June 17, 1902, until such time as full investigations shall have been made and the questions arising in connection therewith be definitely settled.

The importance of this reservoir site may be partially understood from the following figures:

It has been estimated that a dam 200 feet in height, with a top length of 371 feet, would cover a surface area of approximately 15,000 acres, and that its storage capacity would be nearly 1,500,000 acre-feet, the cost per acre-foot being about 75 cents; and that the discharge of Grand River is



No. 3. View looking down from point "B" toward Gore Canyon, three miles away.

a good and sufficient water supply should be provided. Thorough investigations have been made with reference to storage of water along the Colorado, but no feasible plan has been found there. The only possibility remaining consists in the storage of water upon the upper tributaries of the Colorado, and, of all reservoir sites thus far discovered, the Kremmling site seems to be much the best. The lands covering the reservoir and dam site have been withdrawn from all entry, under the terms of the Act of

sufficient to fill this reservoir each year.

Assuming, however, that only one-half of this amount could be stored and used for irrigation purposes, the discharge from the reservoir would be approximately 5,000 cubic feet per second for a period of more than 70 days, making all necessary allowances for evaporation and seepage. If the entire capacity of the reservoir were to be utilized in storing water for irrigation, there would be available 10,000 second-feet for more than 70 days.

The accompanying map shows the 181-foot contour line of the reservoir. It will be seen that even at this level a very short dam would throw water back over 12 miles, while the width of the reservoir from arm to arm would also be approximately 12 miles. If the dam were to be made 250 feet in height, as might be done without difficulty, provided the amount of water available warranted the outlay, the storage capacity might easily reach 2,000,000 acre-feet and the corresponding length and width be 15 miles.

and bottom, and from which the next two photographs shown herewith were taken. Point "C" shows the approximate location of the 181-foot contour line at Red Mountain, about 7 miles from point "A" and approximately half way up the reservoir site.

Photograph No. 2, taken from the point designated above as "B," shows a view looking up Blue River, up which the 181-foot contour goes for about 6 miles. With a dam 200 feet in height, the village of Kremmling, shown in the photograph, would be some 80 feet under water, and it, in



No. 4. Showing Dam Site.

A faint idea of the reservoir site may be obtained from the accompanying photographs:

Photograph No. 1, taken near the site of the dam, and at a point approximately 500 feet about it, designated as "A," shows the valley of the Grand at a moderately high water stage. Point "B" indicates the location of the bluff, about 3 miles from point "A," along which the 181-foot contour line runs, about half way between its top

turn, is about 80 feet above the meadows along the river.

Photograph No. 3, taken from point "B" as designated above, looking down toward Gore Canyon, 3 miles distant, gives some idea of the immensity of the canyon. The point designated as "A," from which photograph No. 1 was taken, is approximately 500 feet above the bottom of the canyon. A dam 200 feet in height would be so low in the canyon that

its top would not be visible from the point at which the photograph is taken, nor from any other point in the basin until the visitor was within a few hundred feet of the dam. It may be seen that, so far as physical conditions are concerned, a dam 1,000 feet high could be built as readily as one 200 feet.

Photograph No. 4 is a view of the dam site. The white lines drawn upon the walls show the top of the proposed dam 200 feet in height, the distance between these points being 371 feet. The material is solid granite, and the amount of masonry required to block the canyon so as to store the enormous amount of water referred to above is astonishingly small.

It will be seen that, in addition to the irrigation possibilities, the opportunities for the development of power, both during the construction and after the completion of the dam, are very great.

It has been estimated that by the constant use of about one-half of the available supply, more than 30,000 horsepower should be delivered to consumers. If this estimate is correct, it would mean an almost inconceivable impetus to the mining industry of Colorado, as there are hundreds of mines that cannot be developed at the present time on account of the high cost of power, either steam or electric. It would mean cheaper lighting and power also for the large cities, and the results would be a great benefit to the entire state.

The fact of greatest importance, however, is that the irrigated areas along the Grand and Colorado rivers might be greatly extended by means of the storage of the flood waters during flood stages, in this reservoir. It is well known that without regulation the flood waters flow off so rapidly that they cannot be utilized to the best advantage in any of the western streams. This regulation is contemplated through the construction of a dam sufficiently high to store all of the surplus waters.

As the forests are removed, the discharge of the mountain streams becomes more and more torrential and less capable of control, threatening bridges, railway embankments, headgates of irrigation canals, farms and even towns and cities. The equalization of the flow by means of such a reservoir as is contemplated, would do away with these dangers, and, on the other hand, would guarantee the most satisfactory and economical use of water.

Numerous other advantages of minor importance might be cited, among which are the scenic attractions presented by a lake from 12 to 15 miles in length, set among such grand surroundings as are found in Middle Park, and the ice crop that could be taken from a great lake of the altitude that this one would have. It is hoped that it will be practicable to develop, to its fullest possibility, this wonderful natural reservoir site.



VAST HIDDEN WEALTH IN THE SEMI-ARID REGION

BY

GUY ELLIOTT MITCHELL

Secretary, The National Irrigation Association

A GREAT inland conquest is being waged by the Department of Agriculture which is completely overturning the time-honored theory that the vast areas in the West which cannot be irrigated can never be made to produce anything but a scant natural growth of grass. The engineer and the ditch builder will bring under cultivation many millions of highly productive acres, but the water supply of the West is limited, and there will remain perhaps half a billion acres of the arid region for which there is no water. The aggressive work of Secretary Wilson's department, however, promises fair to make a very large proportion of this land, heretofore supposed to be entirely unfit for agriculture, into farms through scientific methods of soil culture and the introduction of exceedingly drought-resisting plants.

"There are no bad acres," said Secretary Wilson. "We have no useless American acres. We will make them all productive. We have agricultural explorers in every far corner of the world, and they are finding crops which have become so acclimated to dry conditions similar to our own in the West that we will in time have plants thriving upon all our so-called desert lands. We will cover this arid area with plants of various sorts which will yield hundreds of millions of tons of additional forage and grain for western flocks and herds. Our farmers will grow this upon land now considered practically worthless."

The machinery of Mr. Wilson's department is certainly far-reaching, its explorers are traversing every distant land in the interests of the American

farmer, and especially from the vast high, dry lands of Central Asia, known as the Cradle of the World, where agriculture reaches back from history into dim tradition, have come some of the most remarkable of desert plants, requiring but a minimum of moisture to produce luxuriant yields. The activities of Secretary Wilson's department bode ill for the continuance of any great stretches of our once limitless great desert.

AS GOOD FARMING LAND AS ILLINOIS.

A student of desert reclamation through the agency of drouth plants, is Frederick V. Coville, the Chief Botanist of the Department, who is personally very familiar with the West. "There are millions and millions of acres," said Mr. Coville, "in the strictly arid region, now considered worthless for agriculture, which are as certain to be settled in small farms as were the lands of Illinois. This applies particularly to the great plateaus in the northern Rocky Mountain region. I do not hesitate to predict that the transformation of these barren-looking lands into farms through the introduction of desert plants will be as extensive a work as the enormous reclamation through irrigation."

A case in point, as suggested by Mr. Coville, is indicated in a recent State report of Wyoming, which shows as a result of experiments near Cheyenne on a vast plateau 6,000 feet above the sea that profitable crops can be grown on lands which heretofore have been universally regarded as suitable for nothing but the sparse grazing of cattle and sheep. The area of this class of land in the Northwest is almost immeasurable.

INTRODUCING NEW PLANTS.

David G. Fairchild, an agricultural explorer and in charge of the work of introduction of new seeds and plants, says that the greatest surprises will be in the utilization of what are now considered desert lands, for the growing of special arid land crops requiring but a fraction of the moisture necessary for the growth of ordinary plants such as corn and wheat. "We are finding new plants," he said, "from the far table lands of Turkestan and the steppes of Russia and Siberia, which grow luxuriantly under such conditions of aridity that the crops of the Mississippi Valley farms would wither and die as though scorched by a sirocco."

MACARONI WHEAT.

Macaroni wheat affords a good instance of a crop which is capable of revolutionizing the values of tens of millions of acres of arid land.

"The macaroni wheat belt," said Mark A. Carleton, cereal specialist of the Bureau of Plant Industry, "extends, on an average, the width of the United States, and from the 98th to well beyond the 102d meridian, with a general yielding capacity for half this vast area of 30 bushels per acre and of the other half of 15 bushels."

A MILLION SQUARE MILES.

"It is a matter of millions of acres, then, for this crop?"

"Millions! I should say so. The macaroni wheat country would include a very large fraction of a *million square miles*. Our people are but beginning to realize dimly the utterly vast agricultural wealth which lies latent in this enormous area. The Department of Agriculture is pushing this desert reclamation with great vigor. No year goes by but that finds some one or two or three entirely new varieties or species of plants of wonderful drouth resistance. Macaroni wheat will grow with ten inches of rainfall and yield 15 bushels to the acre where ordinary wheat is an absolute failure. This is two bushels more than the average wheat yield for

the United States. There are many other crops with as great possibilities and which thrive on but slight moisture, including splendid forage plants. I might mention kafir corn, the sorghums, millets, brome grass, as well as new kinds of oats and barleys of wonderful drouth resisting powers, the emmer or speltz, and a long line of others. We are constantly finding new grains and forage plants in the Caucasus, in Algeria, Turkestan and other dry countries which will bring under cultivation amazing areas of the Great American Desert, now looked upon as absolutely unfit for agriculture. It is a somewhat singular thing that no men are so skeptical of the reality of these facts as the residents of this region, but our experiments have already proven what I have said to be actual facts, not theories."

A SPLENDID FORAGE CROP.

Dr. Harvey Wiley, the Agricultural Chief Chemist, says that the sorghums form a very fine stock feed and that their cultivation, along with the millets and other of the desert crops, where corn is an entire failure, insures a vast future development for that great section.

SCIENTIFIC CULTIVATION.

Improved methods of culture and tillage in connection with the planting of these hardy drouth crops will change the face of nature throughout entire States. By what is known as the Campbell System of Soil Culture, the lands of Western Kansas, Nebraska, Colorado, and, in fact, wherever there is a deep loam but where the rainfall is only 14 or 15 inches, can be made to produce heavy crops of grains, while forage plants and orchards and vegetables can be very successfully grown. By sub-surface packing of the soil and continual surface cultivation all of the meager rainfall is conserved in the soil for plant use. Professor Campbell states, and has demonstrated, that by this method "dry farming" can be carried "to the foot of the Rockies," while the semi-

arid farm lands to the east can be made to produce double crops.

All in all, if but a portion of the remarkable work which the Department of Agriculture is carrying on bears the fruit which the men working upon it

predict, the country will see, in the next decade or two, a development of the one-time supposed useless and fearful Great American Desert which will be a source of increasing astonishment to the conservative agricultural student.

CREATION OF FOREST RESERVES A BENEFIT TO MINERS

BY

JOHN D. LELAND

Bureau of Forestry

ACT of June 3, 1878 (20 Stat., 88), provides:

"That all citizens of the United States, and other persons, *bona fide* residents of the State of Colorado, or Nevada, or either of the Territories of New Mexico, Arizona, Utah, Wyoming, Dakota, Idaho or Montana, and all other mineral districts in the United States, shall be and are hereby authorized and permitted to fell and remove, for building, agricultural, mining, or other domestic purposes, any timber or other trees growing or being on the public lands, said lands being mineral, and not subject to entry under existing laws of the United States, except for mineral entry, in either of said" * * * "districts of which such citizens or persons may be at the time *bona fide* residents, subject to such rules and regulations as the Secretary of the Interior may prescribe for the protection of the timber and the undergrowth growing upon such lands, and for other purposes."

Miners on public lands outside of forest reservations are, therefore, restricted to the use of timber on mineral lands in the mineral district where the mine is located. There is no provision of law whereby they can purchase timber at a nominal price. The public lands falling within the provisions of said act are subject to speculative cutting; and are open to gross frauds,

not only against the United States but against the legitimate miner. There is no protection from the danger of fires, or from the danger of the exhaustion of the supply of suitable timber for mining purposes, because both the miner and the speculator cut the choicest timber and leave the tops and lops and other rubbish to invite destructive fires.

The Act of June 4, 1897 (30 Stat., 34-36), under which the forest reserves are administered, provides that:

"Any mineral lands in any forest reservation which have been or which may be shown to be such, and subject to entry under the existing mining laws of the United States and the rules and regulations applying thereto, shall continue to be subject to such location and entry, notwithstanding any provision herein contained."

It also provides that:

"The Secretary of the Interior may permit, under regulations to be prescribed by him, the use of timber and stone found upon such reservations, free of charge, by *bona fide* settlers, miners, residents, and prospectors for minerals, for firewood, fencing, buildings, mining, prospecting, and other domestic purposes, such timber to be used within the State or Territory, respectively, where such reservation may be located."

The said Act further provides:

"Nor shall anything herein prohibit any person from entering upon such forest reservations for all proper and lawful purposes, including that of prospecting, locating, and developing the mineral resources thereof: *Provided*, That such persons comply with the rules and regulations covering such forest reservations."

This law, therefore, places the mineral lands within forest reservations on the same footing with mineral lands outside of forest reservations, and in addition provides the free use of timber and stone.

By the rules and regulations prescribed by the Secretary of the Interior (see circular of December 12, 1901) companies and corporations are held not to come within the meaning of the act; and they are, therefore, not entitled to the free use of timber and stone; but a company or corporation may use the timber on its own claim, or on any one of its group of claims, in development work. The said act of June 4, 1897, however, provides for the sale of certain timber within forest reservations, so that mining companies and corporations are provided with material at their very doors at a minimum of cost, and in a legitimate business-like way.

The utility of this sale provision of the law, and its great advantage to mining companies within forest reservations is forcibly illustrated in the Black Hills Forest Reserve in South Dakota, where the Homestake Mining

Company alone has used under purchase millions upon millions of feet of timber from the reserve. Where would this company get an adequate supply of timber except for the forest reserve and the timber sale provision of the act under which the reserve is administered by the Interior Department? The cost of this timber to the company is practically nominal; the advantage to the reserve is the systematic method of cutting required and in handling the tops and lops. My understanding is that the mining companies in the Black Hills Reserve would consider it a calamity to have the reserve abolished, and that they have a full appreciation of the advantage to their industry of reserved over non-reserved lands.

In the Prescott Forest Reserve, in Arizona, where considerable mining is done, the mine owners are at present face to face with the adverse conditions brought about by the unsystematic methods and destructive forces obtaining before the reserve was created, and now find it difficult to obtain a sufficient quantity of timber for their uses.

It should be evident to those who give the subject careful consideration, that a well protected supply of material right at hand at normal cost is more advantageous to the mine owner than an uncertain, unprotected supply to be obtained, if at all, from the speculator, or by questionable means.

YELLOW PINE IN THE SOUTHWEST

The Bureau of Forestry has Been Studying This Important Tree in Colorado, Arizona, and New Mexico

COMMERCIALLY, the most important tree of Arizona, New Mexico, and southwestern Colorado is the western yellow pine. It is known locally as Black Jack, and in the lumber trade is frequently called white pine. The tree furnishes material for

all kinds of local construction; the towns of Durango, Albuquerque, and Flagstaff are monuments to its exceeding usefulness and value. The quantity of western yellow pine lumber shipped to other parts of the country at present is small, but it is rapidly in-

creasing. Owing to the distance from the eastern markets, shipments are largely in the form of highly finished material, such as doors and moulding. These enter into successful competition in the Chicago market with similar products made of white pine, which the better grades of western yellow pine much resemble.

In the Southwest this species is found scattered over the slopes of the Rocky Mountains at altitudes between 6,000 and 9,000 feet. There are three

product of these mills is consumed in Colorado. The Denver and Rio Grande Railroad affords the principal means of transportation, and is one of the largest users of the timber for ties, bridges, and general construction work.

The second region is in west central New Mexico, in the Zuni Mountains. This timber area is smaller than the former—only fifty miles in length by eighteen miles wide. The stand of pine is more uniform than that of the



Open Forest of Western Yellow Pine on Summit of Chiricahua Mountains, Arizona;
altitude 9,000 feet

regions, however, where it extends over large areas in practically pure stands.

The first of these is in extreme southwestern Colorado and northwestern New Mexico. Here a belt of western yellow pine forest, twenty-five miles wide, runs northwest and southeast for one hundred miles. There are six important mills operating in this territory, supported mainly by Denver trade and capital. A great part of the

Colorado forest, however, and over a large part of the area it is of better development. The Colorado timber is estimated to yield from 3,000 to 4,000 board feet per acre; the Zuni timber will average from 4,000 to 6,000 board feet per acre. Stands of from 10,000 to 25,000 feet per acre occur quite frequently in the Zuni Mountains, but are rare in Colorado. Lumbering has just commenced in the Zuni Mountains, and only one mill of consequence is

working at present. The logs are hauled by rail over one hundred miles to the mill. The output will be largely finished material, which will be consumed locally, or shipped to nearby states and into Mexico.

The third and largest region occupies a strip from twenty to fifty miles wide and over 300 miles long, extending from central Arizona southeast into New Mexico. The greater part of this tract is included within Federal forest reserves. The timber is practically continuous over the whole section, and is pure yellow pine, if canyons, mountain tops, and some dry slopes, where spruce, fir, and juniper occur, are excepted. This is the largest area of pure pine forest in the Southwest. Owing to the varied topography and to local conditions, the stand of timber is not uniform, but

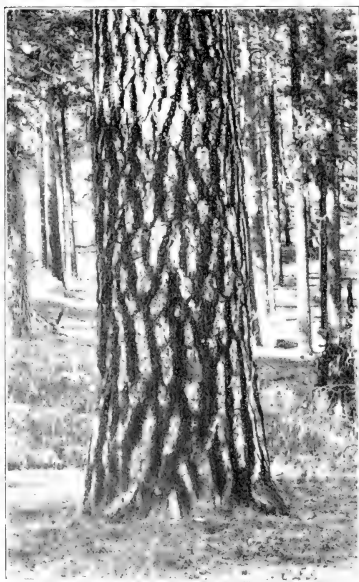
at its best it approaches or equals that of the Zuni Mountains.

There are two large mills in Arizona cutting the pine from private lands within the boundaries of the forest reserve. Like the mill operating in the Zuni Mountains, they are band mills having dry kilns and planers, and are equipped to turn out a product in no way inferior to that of eastern mills. The better grades of lumber are manufactured into doors, siding and moulding, and the lower grades into boxes for vegetables and fruit, or sold locally for building material.

Fire, overgrazing, and drought are the principal evils with which the pine forests of the Southwest have to contend. Fires have been universal, though of late they usually have been confined to restricted areas. One fire rarely does serious damage to mature timber, but many of the old trees now standing are more or less injured by repeated burnings, and where conditions have been favorable, as in dense stands with much undergrowth and litter, mature timber has occasionally been killed outright. The greatest fire loss has been through the destruction of young pines from a few inches in height to trees under six inches in diameter.

Overgrazing is a serious hindrance to tree reproduction. It is an evil of comparatively recent development, and its effects are most frequently seen in the forest of the lower elevations, where there is less moisture than is found further up in the mountains. Large bands of sheep passing and re-passing over restricted areas destroy young pine seedlings in great number by trampling them, and, during years of drought, when the growth of forage is scant, the sheep are forced by hunger to eat many plants they would otherwise neglect. Under these circumstances young pines are stripped of their buds and foliage, and are either killed or badly stunted in growth.

Drought is perhaps the principal factor in determining the distribution of this pine on the lower elevations. Ordinarily yellow pine produces seed

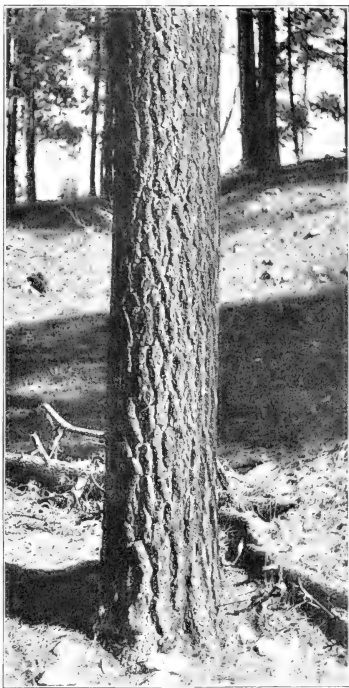


A good specimen of Western Yellow Pine, 48 inches in diameter, Santa Catalina Mountains; altitude 7,600.

plentifully every second or third year, but in this section drought often interferes with the development of the seed or prevents their germination. If a good seed year meets a moist season excellent reproduction results, but if drought continues for several years, seeds are not produced, or very many of the seedlings die. Yellow pine is, however, a hardy tree, and if the seedlings obtain a year's growth a good number may live through succeeding droughts.

The study which has brought out these facts reveals conditions and possibilities of great importance to Colorado, Arizona, and New Mexico. The forests of this region are a valuable source of lumber for home use and for the maintenance of important industries. The timber is good, the forests are easily logged, and industries other than farming and grazing are needed for a rounded development of the region. Without these forests the railroads also would be forced to haul their construction supplies long distances. Most of the land in the forested area is too high to be irrigated, but if the tree growth is fostered the land which it occupies may become an important factor in the conservation of water for the development of agriculture in adjacent regions. The rainfall in this section is largely the product of brief, heavy thunderstorms, or it comes as snow during the winter. Gentle, continuous rains are rare. This condition emphasizes the need for a forest cover on all the slopes, for when the hills are bared by injudicious lumbering, fire, or overgrazing, the storm waters rush rapidly to the bottom, bearing great quantities of soil and rock, or the snow melts with undesirable rapidity under the direct rays of the sun.

For successful reproduction of pine on lumbered areas, fire and overgrazing—the two controllable agencies most destructive at the seedling stage—must be controlled. On the moist slopes and high elevations seed bearing and reproduction are relatively abundant, forage plants are plentiful,



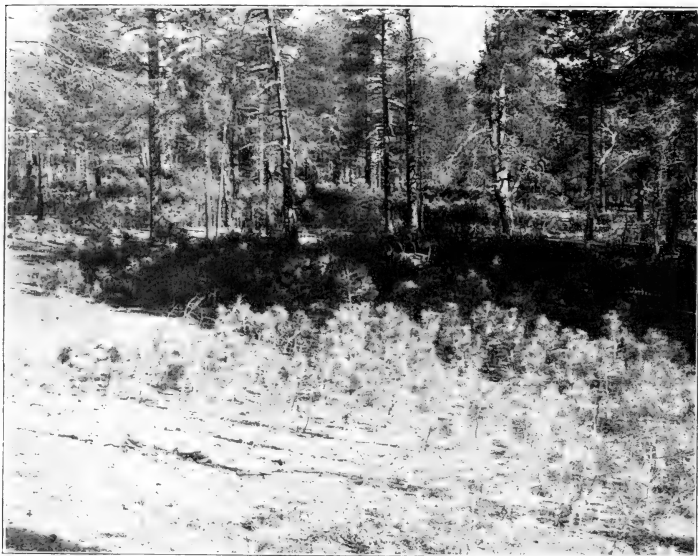
Black Jack type of the Western Yellow Pine.

and water holes and streams are numerous, hence there is little danger to seedlings from trampling or browsing, as is evidenced by the very excellent reproduction often found in places which have been sheep grazed for years. Here fires are the greatest danger, as there is more grass and litter to feed them than at lower levels and on dry slopes. A very careful fire patrol of such territory, keeping close watch on sheep herders and campers during the periods when the forest is free from snow, will insure good reproduction of pine over these moist areas.

On the lower and drier slopes overgrazing is the most destructive agent working against reproduction. Good seed years are less frequent, the quan-

tity of seed is smaller, and the conditions for germination are often very poor, so that reproduction is meager as compared to other areas. Owing to the scant growth of grass and the light isolated litter due to the open condition of the forest here, fires are infre-

Trampling and browsing of seedlings are the determining factors of reproduction on these areas. By regulating the number of sheep to be pastured on any given area, limiting the length of the grazing season, keeping the bands of sheep moving, and not allowing



Excellent reproduction on a Range which has been grazed by sheep and cattle for twenty-five years.

quent and very restricted in extent, and the grazing further reduces the ability of fire to spread by reducing the amount of inflammable material. Scant forage and isolated watering places cause a closer working of localities adjacent to such watering places.

them to be held on small tracts near water holes chosen as handy camping places by the herders, the greater part of the danger from overgrazing can be avoided or reduced to a minimum, and a fair reproduction can be secured in these least favorable localities.



SECOND REPORT OF PUBLIC LANDS COMMISSION

A Document Touching a Vital National Problem that
Deserves the Most Careful Reading by all Citizens

1. This report is based on a broad general view of the public-land situation, not on specific cases.

2. The present laws are not suited to meet the conditions of the remaining public domain.

3. The agricultural possibilities of the remaining public domain are unknown. Provision should be made to ascertain them, and, pending such ascertainment, to hold under Government control and in trust for such use the lands likely to be developed by actual settlers.

4. The right to exchange lands in forest reserves for lands outside should be withdrawn. Provision should be made for the purchase of needed private lands inside forest reserves, or for the exchange of such lands for specified tracts of like area and value outside the reserves.

5. The former recommendation for the repeal of the timber and stone act is renewed and emphasized.

6. The sale of timber from unreserved public lands should be authorized.

7. The commutation clause of the homestead act is found on examination to work badly. Three years' actual residence should be required before commutation.

8. The desert-land law is found to lead to land monopoly in many cases. The area of a desert entry should be reduced to not exceeding 160 acres. Actual residence for not less than two years should be required, with the actual production of a valuable crop on one-fourth the area and proof of an adequate water supply.

9. After thorough investigation of the grazing problem your Commission is opposed to the immediate application of any rigid system to all grazing

lands, but recommends the following flexible plan:

(a) Authority should be given to the President to set aside grazing districts by proclamation.

(b) Authority should be given the Secretary of Agriculture to classify and appraise the grazing value of lands in these districts; to appoint such officers as the care of each district may require; to charge and collect a moderate fee for grazing permits, and to make and apply appropriate regulations to each district, with the special object of bringing about the largest permanent occupation of the country by actual settlers and home seekers.

10. The fundamental fact that characterizes the situation under the present public-land law is this, that the number of patents issued is increasing out of all proportion to the number of new homes.

SECOND PARTIAL REPORT OF THE PUBLIC LANDS COMMISSION.

SIR: This Commission, appointed October 22, 1903, to report upon the condition, operation, and effect of the present land laws, and to recommend such changes as are needed to effect the largest practicable disposition of the public lands to actual settlers who will build permanent homes upon them, and to secure in permanence the fullest and most effective use of the resources of the public lands, submitted to you a partial report dated March 7, 1904, which was printed as Senate Document No. 188, Fifty-eighth Congress, second session. In this report reference was made to the magnitude of the problems and to the fact that it was not then practicable to reach definite conclusions on a num-

ber of the more intricate questions.

Since the time of making this first report many meetings of the Commission have been held and special topics have been assigned to experts for their detailed investigation. The members of the Commission have individually and collectively studied many of the subjects assigned to it. During the year 1904 each member spent much time upon the public lands, making personal inquiries into existing conditions and discussing public-land questions with public men and citizens generally.

The Commission now respectfully submits to you a further partial report.

There is in preparation an appendix containing special reports prepared for the Commission, upon which, in part, the conclusions here presented are based. The Commission desires to express to you its high appreciation of the valuable assistance and support it has received from officers of the General Land Office, the United States Geological Survey (especially the Reclamation Service), and the bureaus of Plant Industry and Forestry of the United States Department of Agriculture.

PROBLEMS PRESENTED.

The total area of the public lands of the United States, exclusive of Alaska, was 1,441,436,160 acres, of which 473,836,402 acres still remained on June 30, 1904. The latter figure, of nearly half a billion acres, while but a third of the original area, is still enormous. Even to see typical examples of these lands in each of the States or larger political divisions would require months of arduous travel. To obtain a full comprehension of all the physical conditions would require years of research. This fact is emphasized because it appears in the general discussion of public-land questions by hundreds or thousands of individuals that as a rule each man sees only certain phases of a group of problems and from his own viewpoint brings argument to bear for or against any one conclusion. Specific cases are

cited to show that certain land laws should be repealed or revised, or should be allowed to remain, and instances are given of the beneficial results of such action.

A correct decision must be based not upon individual cases but upon the broadest attainable knowledge of prevailing tendencies and results. In a hundred cases it may be possible to find 10 excellent illustrations of the beneficial workings of a law, and yet the remaining 90 cases show without doubt that the law on the whole is not good. It is only when large groups of facts are comprehended and analyzed that the real conditions appear.

ANTIQUATED LAND LAWS.

In our preceding report reference was made to the fact that the present land laws do not fit the conditions of the remaining public lands. Most of these laws and the departmental practices which have grown up under them were framed to suit the lands of the humid region. It is evident that the decisions often contemplate conditions such as prevail in the Mississippi Valley and Middle West. Judging cases by arbitrary rules of evidence and considering only such facts as may be presented under these rules, there is much elementary and essential knowledge of which cognizance cannot be taken.

The changes we recommend in the land laws are required not only because some of the present laws are wholly unsuited to existing conditions, but also in part because some of these laws as originally drawn contemplated certain conditions or practices which have been gradually modified by various rulings or decisions. In short, the precedents established and which now have practically the force of law have so completely modified the apparent object of the original statute that the statute and the prevailing conditions appear to be wholly unconnected. The effect of laws passed to promote settlement is now not infrequently to prevent or retard it.

LAND CLASSIFICATIONS.

The agricultural possibilities of the

remaining public lands are as yet almost unknown. Lands which a generation or even a decade ago were supposed to be valueless are now producing large crops, either with or without irrigation. This has been brought about in part by the introduction of new grains and other plants and new methods of farming and in part by denser population and improved systems of transportation. It is obvious that the first essential for putting the remaining public lands to their best use is to ascertain what that best use is by a preliminary study and classification of them, and to determine their probable future development by agriculture.

Until it can be definitely ascertained that any given area of the public lands is and in all probability forever will remain unsuited to agricultural development, the title to that land should remain in the General Government in trust for the future settler.

For example: The passage of the reclamation act (June 17, 1902) made certain the disposition to actual settlers of large areas of land which up to that time had been considered as valueless. Other areas, which are too high and barren to have notable value even for grazing, are now known to have importance in the future development of the country through their capacity to produce forest growth. The making of wells will give an added value to vast tracts of range lands for which the water supply is now scanty. In short, because of possible development, through irrigation, through the introduction of new plants and new methods of farming, through forest preservation, and grazing control, the remaining public lands have an importance hitherto but dimly foreseen.

In view of these facts it is of the first importance to save the remaining public domain for actual home builders to the utmost limit of future possibilities and not to mortgage the future by any disposition of the public lands under which home making will not keep step with disposal. To that end your Commission recommends

(see p. 12) a method of range control under which present resources may be used to the full without endangering future settlement.

After the agricultural possibilities of the public lands have been ascertained with reasonable certainty, provision should be made for dividing them into areas sufficiently large to support a family, and no larger, and to permit settlement on such areas. It is obvious that any attempt to accomplish this end without a careful classification of the public lands must necessarily fail. Attempts of this kind are being made from time to time, and legislation of this character is now pending, modeled on the Nebraska 640-acre homestead law, which was passed as an experiment to meet a certain restricted local condition. This act (33 Stat., 547) permits the entry of 640-acre homesteads in the sand-hill region of that State. Whether in practice the operation of this law will result in putting any considerable number of settlers on the land is not yet determined.

Your Commission is of opinion, after careful consideration, that general provisions of this kind should not be extended until after thorough study of the public lands has been made in each particular case, because to do so controverts the fundamental principle of saving the public lands for the home maker. Each locality should be dealt with on its own merits. Even if it should ultimately appear that this law has worked beneficially in Nebraska it would be no means follow that such a law might be safely applied to other regions different in topography, soil, and climate. No arbitrary rule should be followed, but in each case the area of the homestead should be determined by the acreage which may be necessary to support a family upon the land, either agriculture, or by grazing if agriculture is impracticable. Until such acreage is determined for each locality, any new general law providing a method of obtaining title to the public lands would, in the opinion of your Commission, be decidedly unsafe.

LIEU LANDS.

Careful study has been given by your Commission to the subject of forest-reserve lieu-land selections. These selections have given rise to great scandal, and have led to the acquisition by speculators of much valuable timber and agricultural land and its consolidation into large holdings. Furthermore, the money loss to the Government and the people from the selection of valuable lands in lieu of worthless areas has been very great. There has been no commensurate return in the way of increased settlement and business activity. Public opinion concerning lieu-land selections, by railroads in particular, has reached an acute stage. The situation is in urgent need of a remedy, and your Commission recommends the repeal of the laws providing for lieu-land selections.

A partial remedy by Executive action has already been applied by carefully locating the boundaries of new forest reserves, and thus limiting lieu-land selections to comparatively insignificant areas. The last annual message to Congress declares definitely that—

The making of forest reserves within railroad and wagon-road land-grant limits will hereafter, as for the past three years, be so managed as to prevent the issue, under the act of June 4, 1897, of base for exchange or lieu selection (usually called scrip). In all cases where forest reserves within areas covered by land grants appear to be essential to the prosperity of settlers, miners, or others the Government lands within such proposed forest reserves will, as in the recent past, be withdrawn from sale or entry pending the completion of such negotiations with the owners of the land grants as will prevent the creation of so-called scrip.

There are now lands in private ownership within existing forest reserves, and similar lands must to a limited extent be included in new reserves. Therefore, a method is required by

which the Government may obtain control of non-agricultural holdings within the boundaries of these reserves. Your Commission recommends the following flexible plan: Upon the recommendation of the Secretary of Agriculture, when the public interest so demands, the Secretary of the Interior should be authorized, in his discretion, to accept the relinquishment to the United States of any tract of land within a forest reserve covered by an unperfected bona fide claim lawfully initiated or by a patent, and to grant to the owner in lieu thereof a tract of unappropriated, vacant, surveyed, non-mineral public land in the same State or Territory and of approximately equal area and value as determined by an examination, report, and specific description by public surveys of both tracts, to be made on the ground by officials of the Government. When exchange under these conditions cannot be effected, lands privately owned within forest reserves should be paid for in cases where the public interest requires that such lands should pass into public ownership. The Secretary of the Interior should be authorized to take the necessary proceedings as rapidly as the necessary funds are provided.

TIMBER AND STONE ACT.

The recommendations made for the repeal of the timber and stone act in the previous report are renewed and emphasized. Additional facts showing the destructive effect of this law have strengthened the belief of your Commission that on the whole its operation is decidedly harmful. This law has been made the vehicle for innumerable frauds, and the Government has lost and is still losing yearly vast sums of money through the sale of valuable timber lands to speculators, and hence indirectly to large corporations, at a price far below their actual value. From the passage of the act, June 3, 1878, to June 30, 1904, 55,372 claims for 7,596,078 acres of timber land were patented under its provisions, and on last date 7,644, claims for 1,108,380

acres were pending. Many transfers of land patented under this law are made immediately upon completion of title, often on the same day, to individuals and companies. In this way a monopoly of the timber supplies of the public-land States is being created by systematic collusion. Under the existing rules and practices of the courts it is difficult to prove this collusion, except in cases of open fraud, and it is therefore practically impossible to secure conviction. Furthermore, under bona fide compliance with the actual provisions of the law the effect is almost equally bad. The law itself is seriously defective.

It has been urged in behalf of this act that it enables poor men to enjoy the bounty of the Government by obtaining tracts of timber which they can afterwards sell with advantage. A careful study seems to show, on the contrary, that the original entrymen rarely realize more than ordinary wages for the time spent in making the entry and completing the transfer. The corporations which ultimately secure title usually absorb by far the greater part of the profit.

In addition to the direct loss to the Government from the sale of the lands far below their real value, timber lands which should have been preserved for the use of the people are withdrawn from such use, and the development of the country is retarded until the corporations which own the timber see fit to cut it. The bona fide settler who comes into a country, the timber resources of which have thus been absorbed, may be very seriously hampered by his inability to secure timber except from a foreign corporation. All of the timber land has often passed beyond his reach, and the development of his farm may be retarded and his expenses greatly increased because he can no longer obtain the necessary supplies of fuel, rails, posts, and lumber.

As in the case of other laws, instances of the beneficial operation of this act may be cited, but when it is considered from the point of view of

the general interest of the public it becomes obvious that this law should be repealed.

SALE OF TIMBER ON THE PUBLIC LANDS.

Necessity for the enactment of a law authorizing the sale of timber on non-reserve public land is becoming more evident, and the recommendations made in the preceding report of this Commission are reiterated. For the best use of the public lands it is absolutely essential to hold public timber for sale when needed and in quantities necessitated by the continuous growth of prevailing industries. Provision should also be made for a limited free-use right by miners and actual settlers.

COMMUTATION CLAUSE OF THE HOME-

STEAD ACT.

In the preceding report a statement was made that our investigations respecting the operations of the commutation clause of the homestead law were still in progress. We were not at that time prepared to recommend its repeal. Investigations carried on during the past year have convinced us that prompt action should be taken in this direction and that, in the interest of settlement, the commutation clause should be greatly modified.

A careful examination of the districts where the commutation clause is put to the most use shows that there has been a rapid increase of the use of this expedient for passing public lands into the hands of corporations or large landowners. The object of the homestead law was primarily to give to each citizen, the head of a family, an amount of land up to 160 acres, agricultural in character, so that homes would be created in the wilderness. The commutation clause, added at a later date, was undoubtedly intended to assist the honest settler, but like many other well-intended acts its original intent has been gradually perverted until now it is apparent that a great part of all commuted homesteads remain uninhabited. In other words, under the commutation clause the number of patents furnishes no index to the number of new homes.

To prove this statement it is only necessary to drive through a country where the commutation clause has been largely applied. Field after field is passed without a sign of permanent habitation or improvement other than fences. The homestead shanties of the commuters may be seen in various degrees of dilapidation, but they show no evidence of genuine occupation. They have never been in any sense homes.

Investigations have been carried on where the commuted homesteads are notable in number. The records of some of the counties examined show that 90 per cent. of the commuted homesteads were transferred within three months after acquisition of title, and evidence was obtained to show that two-thirds of the commuters immediately left the State. In many instances foreigners, particularly citizens of Canada, came into this country, declared their intention of becoming citizens, took up homesteads, commuted, sold them, and returned to their native land.

The reasons given for adhering to the commutation clause are diverse and many of them are cogent when applied to individual cases. It is said, for example, that the commuter desires to raise money for use in improving his place. This is often true, but in the majority of cases the records show that the commuter immediately leaves the vicinity. The frequency of loans is traceable in many places directly to the activity of agents of loan companies, who are often United States commissioners also, eager first to induce settlement and then to make these loans on account of the double commission received. Later they secure the business which accrues to them through the foreclosure and transfer of the property. The true working of the commutation clause does not appear until after foreclosure upon the maturity of the loans.

One significant fact brought out by the investigation is that a large portion of the commuters are women, who never establish a permanent residence

and who are employed temporarily in the towns as school-teachers or in domestic service, or who are living with their parents. The great majority of these commuters sell immediately upon receiving title, the business being transacted through some agent who represents his client in all dealings and prepares all papers.

The commutation clause, if it is to be retained to cover special cases, should be effective only after not less than three years' actual—not constructive—living at home on the land. Under present practice, the commutation period being fourteen months, six months of this time is generally taken to establish residence, so that only eight months remain. This time is usually arranged to include the summer, so that the shack built need not be habitable in severe winter weather, and the residence on the land may consist merely in a summer outing. Obviously it is essential that residence should be far more strictly defined. It is probable that lax interpretation and enforcement of the provisions of the law regarding residence is responsible for more fraud under the homestead act than all other causes combined.

It may be urged that the frauds which have taken place under the operations of the commutation clause are due largely to lax administration. The fact is that the precedents established by decisions rendered on special cases have so far weakened the powers of administration that additional legislation is necessary.

DESERT LAND LAW.

In the preceding report the opinion was expressed that the desert-land law should, for the present, at least, be allowed to stand, with a few changes in detail. It was believed that, with the experience of the past for guidance, it would be possible to enforce this law so that its essential provisions could be complied with. More careful analysis, however, of the operations of this act and of the practices which have grown up has led your Commission strongly to the conclusion that

that this law should be modified in essential particulars.

Your Commission recommended last year the repeal of the assignment clause. This provision has been made the convenient vehicle for evading the spirit of the law and for facilitating the acquisition of lands in large holdings. The law limits the amount which one person or association of persons may hold, by assignment or otherwise, prior to patent, to 320 acres of such arid or desert lands. The most common form of attempted evasion of this requirement is for two or three individuals to form themselves into a corporation, each individual member of the corporation securing, by entry or assignment, 320 acres of such lands and the corporation as such 320 acres. These same individuals then form another corporation under an entirely different name and procure an assignment of another 320 acres, and this process is continued indefinitely.

The General Land Office has within the past year endeavored to put a stop to this practice by holding that a corporation or association of persons is not qualified to receive a desert-land entry by assignment where its individual members, either singly or in the aggregate, are holding 320 acres of such arid or desert lands. This ruling, if enforced, will tend to lessen the evils resulting from large holdings prior to patent, but it is not deemed possible to secure adequate control of this question unless the law prohibits assignments of desert-land entries. By repealing that provision of the law and requiring the claimant to show that he has made the entry for his own use and benefit and not for the benefit of any other person or corporation and that he has made no agreement by which the title shall inure to any other person or corporation, the evils incident to large holdings of such lands under the sanction of law will be materially lessened.

It is a striking fact that these large holdings of desert land are not reclaimed and devoted to their best use.

Three hundred and twenty acres of irrigable land is entirely too much for economical handling by one person. On the other hand, inspection shows that in the same locality and under the same climatic conditions the homestead entries, where not commuted, are reclaimed and utilized.

The desert-land act as it stands upon the statute books appears to have many features which commend it, but, as before stated, the practices governing it have largely nullified its good features, and the resulting evils cannot be fully overcome without legislation.

The area of the desert entry should be cut down from 320 acres to not exceeding 160 acres, and discretion should be given to the Secretary of the Interior to cut it down still further where it is apparent that intensive cultivation is practicable. A farm of 320 acres, if irrigated, is entirely too large for a single family, and its possession simply prevents other settlers from coming into the country. Furthermore, it makes land monopoly easy and induces speculation.

Actual living at home on the land for not less than two years should be required before patent. Your Commission cannot understand why any settler should be given both a homestead and a desert entry, either of which without the other should suffice, under the law, to furnish him a home. The desert-land law should be a means of settlement, and actual bona fide residence should be rigidly required.

The actual production of a valuable crop should be required on not less than one-fourth of the area of the entry. At present, as a rule, the greater part of the desert entries are never actually watered. Hundreds of desert entries were examined by members of the Commission in the last year, and the great majority of them were found to be uninhabited, unirrigated, uncultivated, and with no improvements other than a fence. This applies both to desert entries upon which final proof is now being offered and to

other entries to which title has been given.

It is a fact that a very small proportion of the land disposed of under the terms of the law has actually been reclaimed and irrigated, and scrutiny of many hundreds of desert entries now passing to final proof shows that in the majority of cases these lands are not actually utilized, but are being held for speculative purposes. Owing to several causes, among which are the laxity of some of the State laws governing appropriation of water for irrigation purposes, and the insufficiency of the water supply, considerable difficulty has been encountered in administering that provision of the desert-land laws which requires a claimant to have a permanent water right based on prior appropriation. Very often the waters of a stream are exhausted by other appropriators before the time when the claimant goes through the form of posting notices, recording his claim, and complying with other essentials of the State law. Notwithstanding this, he furnishes the testimony of two witnesses that the water thus appropriated has been used in reclaiming his land, and that the supply is adequate for that purpose. While this showing, on its face, indicates a compliance with law, the fact remains that the water supply, if any at all, is not sufficient to permanently reclaim the land.

The ownership of stock in a projected irrigation ditch which does not exist in fact, or the ownership of a pump temporarily installed, has often been accepted, in connection with such testimony, as proof of the possession of water. Many alleged irrigation ditches or reservoirs are familiar to members of the Commission which are utterly inadequate to irrigate a square rod, and upon the strength of such works patent has frequently issued to 320 acres of land.

Frauds committed through conventional forms of perjury and through lack of proper verification of the facts as to the reclamation of the land justify the taking of immediate and radical

steps in the revision of the law. The law should absolutely require an actual adequate water supply, and the limits as to quantity should be defined.

In short, the law should render impossible the continuance of the practices by which desert lands without water, without cultivation, and without crops are passed into the possession of claimants.

GRAZING LANDS.

The great bulk of the vacant public lands throughout the West are unsuitable for cultivation under the present known conditions of agriculture, and so located that they cannot be reclaimed by irrigation. They are, and probably always must be, of chief value for grazing. There are, it is estimated, more than 300,000,000 acres of public grazing land, an area approximately equal to one-fifth the extent of the United States proper. The exact limits cannot be set, for with seasonal changes large areas of land which afford good grazing one year are almost desert in another. There are also vast tracts of wooded or timbered land in which grazing has much importance, and until a further classification of the public lands is made it will be impossible to give with exactness the total acreage. The extent is so vast and the commercial interests involved so great as to demand in the highest degree the wise and conservative handling of these vast resources.

It is a matter of first importance to know whether these grazing lands are being used in the best way possible for the continued development of the country or whether they are being abused under a system which is detrimental to such development and by which the only present value of the land is being rapidly destroyed.

At present the vacant public lands are theoretically open commons, free to all citizens; but as a matter of fact a large proportion have been parceled out by more or less definite compacts or agreements among the various interests. These tacit agreements are continually being violated. The sheep-

men and cattlemen are in frequent collision because of incursions upon each other's domain. Land which for years has been regarded as exclusively cattle range may be infringed upon by large bands of sheep, forced by drought to migrate. Violence and homicide frequently follow, after which new adjustments are made and matters quiet down for a time. There are localities where the people are utilizing to their own satisfaction the open range, and their demand is to be let alone, so that they may parcel out among themselves the use of the lands; but an agreement made to-day may be broken to-morrow by changing conditions of shifting interests.

The general lack of control in the use of public grazing lands has resulted, naturally and inevitably, in overgrazing and the ruin of millions of acres of otherwise valuable grazing territory. Lands useful for grazing are losing their only capacity for productiveness, as, of course, they must when no legal control is exercised.

It is not yet too late to restore the value of many of the open ranges. Lands apparently denuded of vegetation have improved in condition and productiveness upon coming under any system of control which affords a means of preventing overstocking and of applying intelligent management to the land. On some large tracts the valuable forage plants have been utterly extirpated, and it is impracticable even to reseed them. On other tracts it will be possible by careful management for the remaining native plants to recover their vigor and to distribute seeds, which will eventually restore much of the former herbage. Prompt and effective action must be taken, however, if the value of very much of the remaining public domain is not to be totally lost.

The conclusions as to grazing reached by your Commission were based:

First. Upon the results of long acquaintance with grazing problems in the public-land States on the part of each member of your Commission.

Second. Upon the results of careful examinations made for the Commission of the grazing systems of the State of Texas, the State of Wyoming, the Union and Northern Pacific railroads, and of the Indian Office in the case of permits to stockmen for the use of Indian lands suitable for grazing, and of the grazing conditions throughout the West. A map has been prepared showing the general location and area of the summer, winter, and year-long ranges, and the sections which are largely dependent upon a temporary water supply for their utilization in grazing, and those where there has been extensive development by wells and windmills. We believe that this map will be found exceedingly valuable and interesting in the consideration of all grazing problems, and it is therefore submitted in the appendix.

Third. Upon the results of a meeting called to confer with the Commission by the National Live Stock Association in Denver early in August, 1904, which was attended by the Secretary of Agriculture and by representative stockmen from all the grazing-land States and Territories. The opinion of the stockmen present was almost unanimous in favor of some action on the part of the Government which would give the range user some right of control by which the range can be kept from destruction by overcrowding and the controversies over range rights can be satisfactorily eliminated, the only question being as to the most satisfactory method by which such right may be obtained.

Fourth. Upon 1,400 answers received to a circular letter addressed to stockmen throughout the West. These answers show that under the present system the pasturing value of the ranges has deteriorated and the carrying capacity of the lands has greatly diminished; that the present condition of affairs is unsatisfactory; that the adoption of a new system of management would insure a better and more permanent use of the grazing lands; that a certain improvement in range

conditions has already been brought about by range control on the forest reserves, and that the great bulk of the western stockmen are definitely in favor of Government control of the open range.

Fifth. Upon facts presented at many public meetings held throughout the West and upon innumerable suggestions which have been received and considered.

Your Commission concurs in the opinion of the stockmen that some form of Government control is necessary at once, but is opposed to the immediate application of any definite plan to all of the grazing lands alike, regardless of local conditions or actual grazing value. The following plan is intended to bring about the gradual application to each locality of a form of control specifically suited to that locality, whether it may be applicable to any other locality or not. Your Commission recommends that suitable authority be given to the President to set aside, by proclamation, certain grazing districts or reserves. To the Secretary of Agriculture, in whose Department is found the special acquaintance with range conditions and live-stock questions which is absolutely necessary for the wise solution of these problems, authority should be given to classify and appraise the grazing value of these lands, to appoint such officers as the care of each grazing district may require, to charge and collect a moderate fee for grazing permits, and to make and apply definite and appropriate regulations to each grazing district. These regulations should be framed and applied with special reference to bringing about the largest permanent occupation of the country by actual settlers and home seekers. All land covered by any permit so given should continue to be subject to entry under reasonable regulations notwithstanding such permit.

MINING LAWS.

Your Commission has not yet found it possible to take up the extremely important subject of the revision of

the mining laws with the thoroughness which it deserves. From the evidence already submitted it is obvious that important changes are necessary, both in the United States and Alaska. The Commission hopes to treat this matter more at length in a subsequent report.

RIGHTS OF WAY.

Year after year the question of rights of way across the public lands and reservations has been called to the attention of the Congress in the reports of the Secretary of the Interior and the Commissioner of the General Land Office. The laws on this subject are numerous and apparently often incongruous. Rights of way are granted contingent upon the execution of work within a definite time, but decisions and practices are now in force under which it has become almost impossible to divest the public lands of the incubus of these rights, granted conditionally in the first place, but still in existence, although the conditions were not fulfilled.

Rights such as these are very numerous. They lie dormant until actual development has begun to take place, either under the reclamation act or otherwise; then they appear in enormous numbers to the very serious hindrance of new enterprises. Your Commission is engaged on a study of this subject and will report hereafter upon it.

AGRICULTURAL LANDS IN FOREST RESERVES.

Attention is called again to the recommendation of your Commission in its previous report that entry of agricultural lands included in forest reserves be permitted under surveys by metes and bounds, and special emphasis is directed to the recommendation, which is here renewed, that in such cases actual residence at home on the land be rigidly required and that no commutation be allowed.

LARGE AND SMALL HOLDINGS.

Detailed study of the practical operation of the present land laws, particularly of the desert-land act and

the commutation clause of the homestead act, shows that their tendency far too often is to bring about land monopoly rather than to multiply small holdings by actual settlers. The land laws, decisions, and practices have become so complicated that the settler is at a marked disadvantage in comparison with the shrewd business man who aims to acquire large properties. Not infrequently their effect is to put a premium on perjury and dishonest methods in the acquisition of land. It is apparent, in consequence, that in very many localities, and perhaps in general, a larger proportion of the public land is passing into the hands of speculators and corporations than into those of actual settlers who are making homes.

This is not due to the character of the land. In all parts of the United States known to your Commission where such large holdings are being acquired the genuine homesteader is prospering alongside of them under precisely the same conditions. Wherever the laws have been so enforced as to give the settler a reasonable chance, he has settled, prospered, built up the country, and brought about more complete development and larger prosperity than where land monopoly flourishes. Nearly everywhere the large landowner has succeeded in monopolizing the best tracts, whether of timber or agricultural land. There has been some outcry against this condition. Yet the lack of greater protest is significant. It is to be explained by the energy, shrewdness, and influence of the men to whom the continuation of the present condition is desirable.

Your Commission has had inquiries made as to how a number of estates, selected haphazard, have been acquired. Almost without exception collusion or evasion of the letter and spirit of the land laws was involved. It is not necessarily to be inferred that the present owners of these estates were dishonest, but the fact remains that their holdings were acquired or consolidated by practices which cannot be defended.

The disastrous effect of this system upon the well-being of the nation as a whole requires little comment. Under the present conditions, speaking broadly, the large estate usually remains in a low condition of cultivation, whereas under actual settlement by individual home makers the same land would have supported many families in comfort and would have yielded far greater returns. Agriculture is a pursuit of which it may be asserted absolutely that it rarely reaches its best development under any concentrated form of ownership.

There exists and is spreading in the West a tenant or hired-labor system which not only represents a relatively low industrial development, but whose further extension carries with it a most serious threat. Politically, socially, and economically this system is indefensible. Had the land laws been effective and effectually enforced its growth would have been impossible.

It is often asserted in defense of large holdings that, through the operation of enlightened selfishness, the land so held will eventually be put to its best use. Whatever theoretical considerations may support this statement, in practice it is almost universally untrue. Hired labor on the farm cannot compete with the man who owns and works his land, and if it could the owners of large tracts rarely have the capital to develop them effectively.

Although there is a tendency to subdivide large holdings in the long run, yet the desire for such holdings is so strong and the belief in their rapid increase in value so controlling and so widespread that the speculative motive governs, and men go to extremes before they will subdivide lands which they themselves are not able to utilize.

The fundamental fact that characterizes the present situation is this: That the number of patents issued is increasing out of all proportion to the number of new homes.

Respectfully submitted.

W. A. RICHARDS.

F. H. NEWELL.

GIFFORD PINCHOT.

A GREAT HARDWOOD FOREST

The Eight Principal Species of the Southern Appalachians Have Been Studied by the Bureau of Forestry

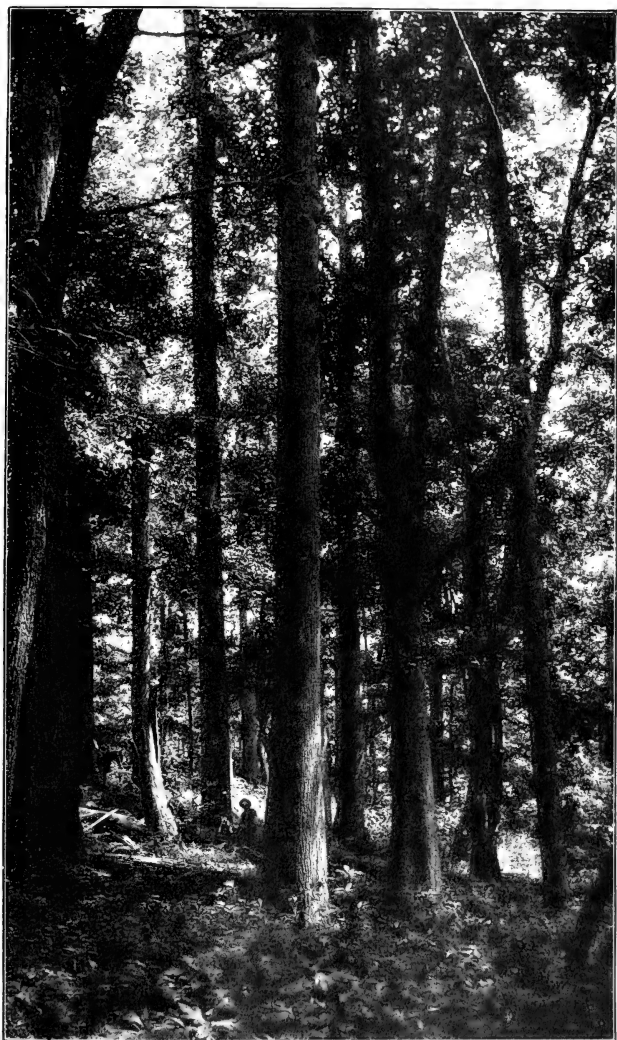
THE greatest area of hardwood forest and the largest supply of hardwoods in the United States are in the region comprising the Southern Appalachian Mountains and the country lying between them and the Mississippi River. For the last two or three years the Bureau of Forestry has been carefully studying this region, which is rich in commercial species, especially yellow poplar, white, red, black, and chestnut oak, chestnut, white pine, and hemlock. A study was first made of the proportion of each of these species in the various types of forest, their merchantable yield, and their rate of growth. Last summer, eleven agents of the bureau were assigned to an investigation of the market conditions governing the logging and use of each of these species, and twelve more to a study of the important characteristics of each tree and the possibilities of each under management. The data obtained in this and previous studies are now being formulated for publication. Several bulletins will be issued, one of a general character discussing the conditions of the region as a whole, the others dealing with the several species particularly.

The field study covered more than 400 counties, and included all of Tennessee, Kentucky, and West Virginia, the extreme western part of Maryland, the western portions of Virginia and the two Carolinas, and the northern parts of Georgia and Alabama. The bureau agents first visited the lumber centers of each county to interview the mill men and lumber dealers. Information was sought especially on these points: The remaining stands of timber and their quality; the annual cut and the uses to which it is put; land and stumpage values, the cost of logging and milling, and the prices of the finished product; the methods of log-

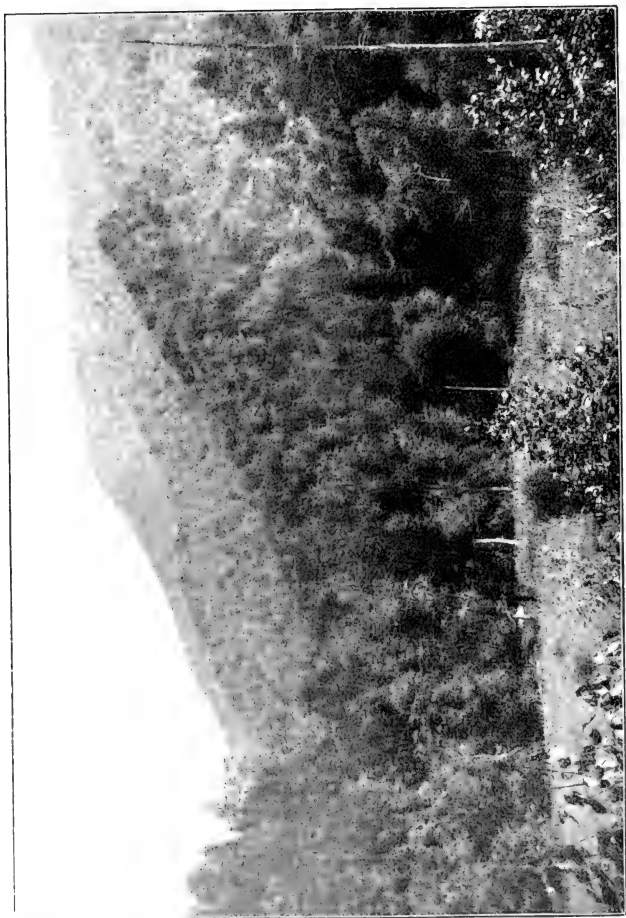
ging employed, the specifications for timber in common use, and how these specifications are changing; and the principal markets for lumber. The object of this preliminary work was to gain a thorough understanding of the market and business conditions prevailing in the hardwood regions. Such knowledge was necessary before the men could go into the woods and work out intelligently the best and most practical methods of handling the forests.

The study of the general forest conditions and the characteristics of each of the important species followed. This study included inquiry into the requirements of each species as to light, soil, and moisture, its seeding and reproductive capacity, its form and development in different types of forest, and the ways in which the various species affect each other in the competition for place and light; also the present methods of cutting, waste in logging, and the effects of logging upon the forest. To determine the chances of natural reproduction under existing logging methods, second growth and culled lands in all stages were carefully studied. The effects of fire and grazing upon the forest were also considered. Until the voluminous data thus obtained have been tabulated and compared absolute figures and conclusions cannot be announced, but sufficient progress has been made to warrant some general statements of conclusions.

For market value and amount of standing timber yellow poplar and white oak are the two most important trees of the region. These species were formerly found throughout almost the entire region in merchantable quantities, but they have been cut so extensively where there are transportation facilities that it is now usually



A Hardwood Forest Showing Good Specimens of the Tulip Tree, or Yellow Poplar, (*Liriodendron tulipifera*).



Typical Forest-covered Mountain Side.

necessary to go back a long distance into the woods to find first-class stands of either of them. Poplar attains magnificent size in the coves of the mountain districts and in the rich river bottoms of central Tennessee and Kentucky, but its best development is reached in the higher mountains of Tennessee and North Carolina. White oak reaches its best development in the river valleys of Tennessee and Kentucky. White poplar always forms a small proportion of the timber of the area; it very often forms a large proportion of the merchantable timber. White oak is present in very much greater numbers than poplar over the region as a whole, and occasionally forms over 50 per cent of the stand.

Lumbering has had a serious effect on the reproduction of both poplar and white oak. When the white oak is cut, as a general rule it is partially replaced by inferior species, as the red and black oaks. Thus in many cases where the virgin stand contained over 50 per cent of white oak, the second crop contains less than 10 per cent. Often when poplar has been lumbered, only the best trees have been cut, and as these were comparatively few in number and occurred at irregular intervals the forest has not been opened up enough to let in sufficient light to allow young poplars to start growing. In addition, poplar seedlings are very easily injured by fire; even slight ground fires kill them. Fires have been very common throughout the region, and thus successful reproduction of poplar has often been greatly hindered.

Hemlock occurs over a small portion of the region, and white pine over a still smaller part; both confine themselves to the mountainous sections. As a rule hemlock has not been considered merchantable, because it is generally impossible to log and sell it in northern markets in competition with hemlock from Michigan and Pennsylvania. The little remaining white pine is lumbered in a few localities on a large scale, and the supply will soon be exhausted.

Chestnut is very abundant. It forms a large proportion of the stand in the mountain districts, but decreases in quantity westward, until it practically disappears in western Tennessee and Kentucky. Mature chestnut is damaged more severely by fire than any of the other species of the region. A considerable part of its mature timber is defective for this reason. Much of the timber is also wormy. In the past but little chestnut has been cut for lumber, but the output is now increasing. A new use for chestnut, which has developed very rapidly in the last few years, is for making tannin extract. For this purpose all grades and sizes of chestnut above about five inches in diameter are used. There are a number of factories making the extract, one of which consumes 150 cords of this wood daily. This industry makes possible the utilization of the limbs and tops and the defective chestnut which otherwise would be wasted, and materially assists in conservative management by making this timber more valuable and cleaner logging practicable.

Chestnut oak is abundant in the mountains, its stand decreasing westward. It is confined chiefly to the ridges, and in most sections is short-bodied and of little value for sawlogs. It is usually expensive to lumber because of its inaccessibility. The chief value of chestnut oak in this region has been for tanbark, for which, in some places, it has been largely cut.

Red and black oak are most abundant in the western lowland part of the region, where they often form over 70 per cent of the stand. In addition to their use in large amounts for lumber and slack cooperage, they are also now extensively cut along the navigable rivers for railroad ties, for which purpose preservative treatment has recently made them available. These oaks form but a relatively small part of the forests in the eastern mountainous districts, where in the past almost none of them have been cut, owing to their low market value. But now lumber-

men who are operating in the mountains take these oaks along with the poplars and white oaks.

There are a number of large permanent mills, but over the region as a whole most of the lumbering is still done by portable mills. These move through the timber, and the cutting is cleaner than it formerly was. This

turing plants depend upon it for mill supplies. The most important of these industries are those using hardwoods for slack and tight cooperage, for lumber, furniture, finishing, railroad ties, tannin extract, and wagon stock. In addition to furnishing wood for all these and other purposes, the forest of this region has a vital function to per-

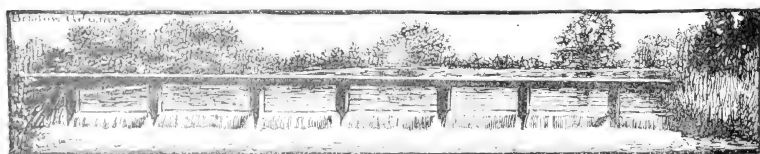


View of a deforested hillside, showing effect of erosion, Southern Appalachian Region.

heavier cutting, on account of the requirements of the two most important species, poplar and white oak, for light, is usually a good thing for the future crop, especially for poplar reproduction.

The demands upon this hardwood forest are enormous and varied. Great industries employing large manufac-

form in protecting a watershed upon which a number of states depend for a constant supply of water. It is doubtful whether the Bureau of Forestry has ever undertaken a more important study, and its forthcoming bulletins should prove very valuable to many commercial interests as well as to forestry in general.



RECLAMATION SERVICE NEWS

Public and Private Enterprise--Sun River
District--Surveys in North Dakota

THE relation between public and private enterprise has been the subject of some controversy since the passage of the Reclamation Act. It was assumed by many that the reclamation engineers would confine their operations to developments which offered no attractions to private enterprise, such as the construction of storage reservoirs on over-appropriated streams, or the building of canals to divert the water from unused streams into rivers where scarcity existed. In other words, that the Reclamation Service should be confined to operations which would tend to the general amelioration of conditions existing in the arid regions, without coming into commercial relations with the land or people benefited by its action. While this would be vastly more satisfactory to those charged with the execution of the Reclamation Act, it would not carry out the provisions of the law that the amounts expended should be repaid by the lands benefited. This provision of the Reclamation Act makes it the first duty of its executives to select for its operations feasible projects, in which the owners of the land can afford to repay to the Reclamation Fund the actual amounts expended in their reclamation.

The fact that the funds used under the Reclamation Act are relieved from interest charges makes many projects feasible which could not be profitably carried out by private enterprise, but this is more than offset by the perennial hopefulness of the private promoter. Every possibility of irrigation development in the arid region has been exploited at some time by somebody, and if it should be held that the Reclamation Service should not interfere with private enterprise, it must either cease its operations or confine them to projects so utterly

chimerical that there would be no human possibility of the return of the money expended.

While it should be the policy of the service to cooperate with and assist all legitimate private irrigation development, it should not allow a false sense of fairness to deprive any community of the opportunity to effect its development along the broadest possible lines, and it would be anything but fair to such a community to decide that an attempt to irrigate its lands had created a mortgage upon them, and that they must be left to be exploited for private profit, regardless of the wishes of those most vitally interested. It is the rule that wherever the Reclamation Service has started its investigations, it has found some part of its project overlapping lands which are being exploited by private enterprise. In such cases if there is a reasonable probability that the enterprise will be carried out, its lands should not be included, unless their exclusion would cripple the project, and in this case some equitable arrangement should be made with the interests involved.

SUN RIVER DISTRICT, MONTANA.

Extensive plans have been formulated by the U. S. Reclamation Service for work during the coming season in the Teton and Sun River District, Montana. They involve reconnaissance and detailed surveys of reservoir sites and irrigable lands, the running of canal lines and examination of new territory. This work is under the immediate direction of Engineer S. B. Robbins. It is hoped to complete the necessary study of this section, so that definite plans as to the feasibility of reclamation may be decided upon this year.

As soon as the season permits, a field

party will be engaged upon the location of main canal lines between Sun and Teton rivers; another will make preliminary surveys on the south side of Sun river, completing work in the vicinity of the canyon and thence working across the divide into Missouri Valley, near Ulm and Cascade, and a third party will make a detailed survey of the proposed dam and reservoir sites in the mountain on the forks of the North Fork and Sun River, later engaging in the survey of irrigable lands.

A fourth party will make a reconnaissance of the country lying between the Teton and Marias drainage. The withdrawal of lands in connection with the Sun River project in this section has resulted in holding up a small project which was undertaken by private enterprise. This plan includes the storage of the flood waters of Teton River in what is known as the old Wilson reservoir No. 29, the summer flow being entirely utilized by irrigators along the stream. It is believed that about 30,000 acres can be easily and cheaply supplied. A thorough investigation will be made of all the irrigation possibilities between Teton and Marias headwaters in this vicinity, that the best development of the country by the available water supply may be decided upon.

As a result of the preliminary surveys made in 1904 it is estimated that over 200,000 acres of bench land between Sun and Teton Rivers are capable of reclamation, a large percentage being vacant land. It is also believed to be practicable to irrigate 100,000 acres lying south of Sun River and between that stream and the Missouri, if water can be had in sufficient volume.

SURVEYS IN NORTH DAKOTA.

The plans of the Reclamation Service for the season 1905 in North Dakota contemplate very careful surveys of the valley of the Missouri, with a view to presenting definite plans for a number of irrigation projects to the settlers residing in the valley.

Last year the preliminary surveys were made of the Buford-Trenton and Nesson projects, and the plans for the former have been approved. This season it is expected to make a complete topographic survey of the Buford-Trenton project, to lay out the canal lines, to make surveys and complete plans for the power plant and all other necessary works, including dams in the various coulees and surveys of any reservoirs which these coulees may offer. A drill party will make borings at the site of the power house, and at sites which are selected to supply coal for this project.

If it appears that the Government's plans will have the approval of the settlers, it is possible that the work can be pushed far enough this season to completely construct the main canal at least, and to erect and equip the power plant. Early in the spring a careful study will be made of the run-off of various coulees in order to determine how much water they will supply for the system. As the work is now planned, at least two topographic parties will be needed continuously, and at the beginning of the season it is expected to add other parties and later use them on the different projects which are being developed in this section.

A reconnaissance and preliminary survey of the Williston project will be made this year, and if the data developed are favorable it may be possible to do some of the permanent topographic work.

On the Nesson project the work will be similar to that on the Buford-Trenton. The coulees must be studied and a topographic map of the district made. Plans and borings will be required for the power plant location, and plans for any reservoir and dam sites which the coulees may offer. The local coal conditions must also be investigated, and the canal line run. It is doubtful if construction can be begun on this project this season.

On the Cherry Creek project work will probably be confined to reconnaissance and preliminary surveys, a

portion of the work being done by the engineers in charge of the Nesson project.

The North Dakota work, as planned, will require the permanent assignment of three assistant engineers and three aids, and later an additional assistant engineer and an additional aid, a draftsman and a computer. The future work of the Government, of

course, depends very largely upon the sentiment of the land owners in the several districts wherein irrigation works are likely to be developed. The preliminary investigations will be made as rapidly as possible, in order that the service may present to the people for their approval a definite plan of reclamation for North Dakota arid lands.

WHAT DO WE PLANT?*

What do we plant when we plant the tree?

We plant the ship, which will cross the sea.

We plant the mast to carry the sails;

We plant the planks to withstand the gales—

The keel, the keelson, and beam and knee;

We plant the ship when we plant the tree.

What do we plant when we plant the tree?

We plant the house for you and me.

We plant the rafters, the shingles, the floors,

We plant the studding, the laths, the doors,

The beam and siding, all parts that be;

We plant the house when we plant the tree.

What do we plant when we plant the tree?

A thousand things that we daily see;

We plant the spire that out-towers the crag,

We plant the staff for our country's flag,

We plant the shade, from the hot sun free;

We plant all these when we plant the tree.

*From the poems of Henry Abbey, D. Appleton & Company, New York.



RECENT PUBLICATIONS

Some of the Principal Insect Enemies of Coniferous Forests in the United States. Reprint from Yearbook, U. S. Department of Agriculture, for 1902. By A. D. HOPKINS. Pp. 13, illustrated. Washington, Government Printing Office, 1902.

Dr. Hopkins states as a noteworthy fact that the most important enemies of coniferous forests in this country are restricted to a few species of a single genus of beetles. The methods of preventing destructive invasions, with descriptions of results of the insects' work, illustrated with numerous plates, together with a description of the insects themselves, forms the basis of the text.

Insect Injuries to Hardwood Forest Trees.

Reprint from Yearbook, U. S. Department of Agriculture, for 1903. By A. D. HOPKINS. Pp. 14, illustrated. Washington, Government Printing Office, 1903.

Discussion of the insects injurious to hardwood trees is grouped under two heads—those injuries which result in the death of the tree, and those which do not materially affect the vitality of the tree, while rendering its wood commercially inferior. The means of distinguishing the insects and combating their work are given, and in general the pamphlet forms a companion work to the one reviewed immediately above, covering the damage done by insects to the two great classes of forest trees.

Transactions of the English Arboricultural Society. Vol. VI—Part I. Compiled by JOHN DAVIDSON, Secretary and Treasurer. Pp. 128, illustrated. Carlisle, G. and T. Coward, 1905.

This volume includes the minutes of the twenty-third annual meeting of the English Arboricultural Society, a report of the annual excursion, and five contributed articles on forest subjects, together with statements of the work and aims of the Society, and matters of general interest to its members. Perhaps the most interesting portion of the Transactions to American forest students and foresters is the account of the Forestry Exhibition at the Royal Show in 1904, contributed by North Wind, Esq. Mr. Robert Anderson, F. S. L., contributes an interesting article on "The Production of Coniferous Timber." The volume is a valuable one, and illustrates by its reports of the society's flourishing condition the sincere interest generally shown forestry in England.

Foreign Trade in Farm and Forest Products, 1904. Circular No. 16, Bureau of Statistics, Department of Agriculture. Pp. 19. Washington, Government Printing Office, 1905.

Here is a mass of valuable statistical matter relating to farm and forest products, tabulated conveniently for reference. With the exception of a brief introductory explanation, the entire pamphlet consists of statistical matter.

Annual Reports of the Department of Agriculture for the Fiscal Year Ended June 30, 1904. Pp. 560. Washington, Government Printing Office, 1904.

A general, brief, summing-up of the work of each of the Bureaus, Divisions, and Sections of the Department of Agriculture is included, with a report of the Secretary in the first portion of this volume; and a detailed report from each of the Bureau and Division chiefs comprises the second part. Mr. Gifford Pinchot, Forester, outlines the work of the Bureau of Forestry during the past year and speaks of its progress in efficiency, compactness, and simplicity of its organization, and appends a chapter on the present and future work of the Bureau during 1905.

Catalogue of Insect Enemies of Forests and Forest Products at the Louisiana Purchase Exposition, St. Louis, 1904. Bulletin No. 48, U. S. Department of Agriculture. By A. D. HOPKINS. Pp. 53, illustrated. Washington, Government Printing Office, 1904.

Dr. Hopkins estimates that an average annual loss of \$100,000,000 is occasioned to the forests of this country through the detrimental or destructive work of insects. At the Louisiana Purchase Exposition there were exhibited 789 specimens of such insects, 623 specimens of their work, and 18 photographs, illustrating extent of damage done. The Bulletin presented here is in the nature of a catalogue of the exhibit, with explanatory notes, and numerous half-tones and line drawings amplify upon the text.

Injury to Vegetation by Smelter Fumes. Bulletin No. 89, Bureau of Chemistry, U. S. Department of Agriculture. By J. K. HAYWOOD. Pp. 23, illustrated. Washington, Government Printing Office, 1905.

The investigation described in this Bulletin was undertaken at the request of the United States Department of Justice in consequence of a suit brought by the United States against the Mountain Copper Company, near Redding, Calif. The general conclusion drawn by the author is that such fumes are injurious to vegetation, and he suggests that they be condensed, and sulphuric acid formed, for which there should be a ready market.

Foresters and Inspectors Wanted for the Philippine Forestry Bureau.

The salaries of Foresters, Assistant Foresters Inspectors, and Assistant Inspectors range from \$1,200 to \$2,400 per year. Actual and necessary traveling expenses to and from the scene of field work are allowed, and while in the field one dollar gold per day is allowed for subsistence.

A list of existing vacancies may be obtained from the Bureau of Insular Affairs, War Dept., Washington, D. C.

The work of the Foresters is, to a large extent, technical; that of the Inspectors more administrative and less technical. All applicants for the position of forester and inspector will be required to pass the Forest Assistant examination.

Date of examinations will be held in different parts of the United States at same time as for the position of Forest Assistant in the U. S. Bureau of Forestry.

The reports, bulletins and other application of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressing the Forestry Bureau, Manila, P. I.

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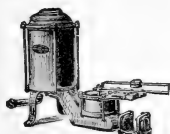
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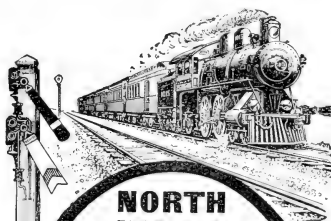
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OF THE

American Forest Congress

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Forestry and Irrigation

H. M. SUTER, Editor

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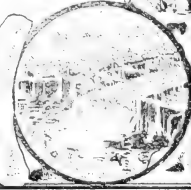
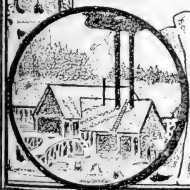
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NEWS AND NOTES

Proceedings Delayed

Through unavoidable circumstances in preparing the proceedings of the American Forest Congress for publication in book form, the issuance of the finished volume has been delayed beyond the time originally counted on. The entire matter is now in the hands of the printer, and the volume will appear by June 1, and perhaps several days in advance of that date.

New Consulting Engineer

As announced in the daily papers, Mr. Carl Ewald Grunsky, formerly a member of the Panama Canal Commission, was recently appointed consulting engineer and adviser to the Director of the U. S. Geological Survey, at a salary of \$10,000 a year. Mr. Grunsky was born in San Joaquin county, California, on April 4, 1855. He attended the public schools of Stockton, being the only male member of the first class graduated from the Stockton High School in 1870.

After teaching school for a year as principal of South School, in Stockton, he determined to acquire a professional education in Germany. Accordingly he spent nearly six years in Stuttgart, Württemberg, as a student in the "Real-Schule" and in the Polytechnic Institute, from which he was graduated as civil engineer at the head of his class in 1877.

His first professional employment was as topographer with a river surveying party of the State Engineering Department of California, in 1878. He was made assistant State Engineer in charge of computations and office

work relating to stream gaging in 1879, and was advanced to Chief Assistant in 1882, continuing as such till 1887.

From 1887 to 1899 he was in private practice at Sacramento and in San Francisco, also serving during 1889 and 1890 as a member of the Examining Commission on Rivers and Harbors for California. In 1892-93 he was one of the engineers selected to design a sewer system for San Francisco, and served on the Sewerage Board of that city. In 1893-94 he again served the State of California as a consulting engineer to the Commissioner of Public Works, dealing with drainage and river rectification problems.

A Board of Public Works was created by a new charter for San Francisco, in January, 1900. This board, under the presidency of Col. G. H. Mendell, appointed Mr. Grunsky City Engineer of that city, which position he held until appointed one of the Isthmian Canal Commissioners. As City Engineer of San Francisco he made plans for a municipal electric light plant, a municipal gas works, a municipal telephone system, water works for a supply of water from the Sierra Nevada Mountains, estimated to cost about \$40,000,000; a city railway system and various public improvements, including a system of main sewers (\$7,250,000), public buildings and parks for which bonds have been voted aggregating about \$17,000,000.

In private practice, Mr. Grunsky has been engineer for several irrigation and drainage districts and con-

sulting engineer for a number of cities on sewerage and water supply systems. In 1897 he contributed several water supply papers to the U. S. Geological Survey's publications, and in 1899 and 1900 was one of the experts reporting to the United States Department of Agriculture upon irrigation and use of water from rivers in California.

Railroad Rates for Reclamation Service.

In carrying on the work of the Reclamation Service, it was found that the various railroad companies recognized the value to them of the railroad traffic to be built up as a result of the development of the country by the Government irrigation systems. The companies were willing to assist in every way possible, and accordingly, contracts were made between various western companies and the Secretary of the Interior to provide for concession of rates for freight carried in connection with the construction performed by the Reclamation Service.

These concessions of rates were made in pursuance of section 22 of the Interstate Commerce Act, which permits railroad companies to carry free or at reduced rates any material for the United States.

These contracts provide that contractors' plant to be used in connection with these projects is to be carried at certain reduced rates, and the question has arisen whether such arrangements are lawful.

This question was carefully considered by the Department when these contracts were before the Secretary of the Interior for execution, and it was held that the method adopted by the Reclamation Service to obtain the benefit of these rates brought these concessions within the law, because all bidders on the construction work were notified of the reduced rates and each of them necessarily figured upon reduced rates to be given by the railroad companies in preparing their bids for the work.

In this manner, the bids were all made on the basis of the low freight

rate and were necessarily less by an amount equivalent to the concessions of rates made by the railroad companies.

The question has been much discussed in the press recently, and the Interior Department has submitted the entire matter of the legality of these contracts to the Attorney-General.

The amounts involved are very large, as the plant and material used in the construction of these projects are very bulky and the freight amounts to a large sum. It is estimated that on the Truckee-Carson project, in Nevada, the freights paid already amount to over \$100,000, and this is about one-tenth of the amount expended by the Government upon the construction.

The concessions in rates given by the railroad companies vary according to the nature of the material. In some cases the reduction is as much as 50 per cent. Considering that there are now under construction, or soon to be undertaken, twelve different irrigation systems, it is evident that the saving on these freights will in a few years be sufficient to enable the Reclamation Service to construct an additional million-dollar project solely from the savings on this account.

It is to be hoped, therefore, that the views of the Interior Department to the effect that the entire benefit of these concessions is obtained by the United States, will be found correct by the Attorney-General, as it will mean a very considerable increase in the amount of construction which can be undertaken by the Government under the Reclamation Act.

State Foresters Wanted

State foresters are wanted both in Indiana and California.

In the first-named State his duties will be to take charge of the State forest reserve and to further the cause of forestry in the State by cooperation with private owners, by studies, and by lectures. The salary is fixed at \$1,500 in the beginning. In California, a forester is wanted to execute, under the supervision of the State

Board of Forestry, all matters pertaining to forestry within the jurisdiction of the State, as provided in the act of March 20, 1905. The salary offered is \$2,400 a year. Application for either of these positions should be made to the Forester, U. S. Department of Agriculture, Washington, D. C.

Colorado College Starts Arboretum

The Colorado State Agricultural College, at Fort Collins, will start an arboretum on the college farm at that place this spring. It is proposed later to include shrubs in the arboretum, but this year only trees will be selected, and the varieties include nearly every kind and species growing in the latitude of Cincinnati. It is a rather unusual fact that no hickory, beech, ironwood, gum or sassafras, and only isolated specimens of the American oak are found in Colorado, and the specimens of these kinds of trees included in the arboretum will be the first in that State as far as is known. The college is preparing for an extended experiment with black locust and catalpa speciosa. It plans to secure the coöperation of about 20 farmers over the State, who will assist in the matter; the college to furnish the stock and direct the planting, and the farmers the land and labor. The contemplated plans call for plantations each comprising one-half an acre, planted to the two varieties, each half, and containing 600 trees. The catalpa has been tried to a certain extent in Colorado and found wanting, but it is claimed that its failure to fulfil expectations is due to the fact that nearly all varieties found in the State are hybrids, or of the tender variety, it being a difficult matter to find a pure catalpa speciosa.

Aside from the value this experiment by the Colorado State College will undoubtedly have in increasing the forested area of the State, its arboretum should establish what trees are best adapted to Colorado—those which will thrive under such climatic and soil conditions as are most prevalent.

Maine's New Forest Law

An act comprising in general the provisions of the old Maine forest law, but with the modifications recommended by the Bureau of Forestry after a study of the control and prevention of forest fires in Maine, was approved on March 8. The Forest Commissioner is directed to establish forest districts and appoint for each a chief fire warden and deputy fire wardens to carry out the provisions of the act. Specific outline of the duties of each is given and the former are allowed \$2.50 per day compensation for actual work, with fees for prosecutions of violators of the laws, and the latter receive \$2.00 per day actually employed. Expense incurred under the provisions of this act is to be paid for from the funds appropriated to and for the use of the Forest Commission.

Oregon Has a Forest Law

Under the title, "An Act providing for the protection of the forests and timber of the State of Oregon, and for protection from forest fires, and the destruction of timber by fire, and providing for the appointment of fire rangers and their duties," etc., the Oregon legislature passed a comprehensive measure looking for the protection of its forests. In the act is defined a "close season," from June 1 to October 1, in which period of time penalty is imposed for any person operating a locomotive, engine, etc., without a spark-arrester in or near woodland. Also during that same time, no fires shall be set in or near woods or in the vicinity of grain lands, without permit, and the maximum fine is fixed at \$1,000. Punishment is provided for careless campers, hunters, woodsmen, lumbermen, etc., who use fire in wooded areas unless certain precautions are taken. Fire notices are to be posted, and a penalty is imposed for their defacement or destruction. Section 9 provides that "Any person who shall detect anyone violating any of the provisions of this act, and shall furnish information leading to the arrest and conviction of such

person, shall receive one-half of the fine paid by such person so convicted.

* * *

**New York's
Forest Policy** In a message to the State legislature, transmitted on March 9, Governor Higgins outlined his policy in regard to the administration of the State forest lands. The gist of his recommendations are as follows:

(1) That the proposed constitutional amendment permitting the removal of burnt timber be not submitted to the people.

(2) That the forest laws be so amended as to insure the prevention of trespass, to compel the prosecution of malicious trespassers, both civilly and criminally, to the full extent of the law, and the seizure by the State of all timber cut or removed by trespassers from State lands, and to prevent the condonation of trespassers.

(3) That provision be made for the submission to the people of a constitutional amendment permitting a more scientific delimitation of the forest reserve, so as to permit the sale of lands other than wild forest lands now included in the preserve, and the purchase with the proceeds thereof of other forest lands.

Should these provisions be ratified by the legislature, it means a whole change in the policy of New York in regard to her forest lands. The policy at present in force absolutely prevents, on State lands, the practice of scientific forestry, since it provides that all forest preserves should forever be kept as "wild forest lands."

As a result of these recommendations, Senator Allds introduced a bill for the reorganization of the State plan for the protection of the forests. The bill places the care of the forests in the Forestry Department of the Forest, Fish and Game Commission, and gives the Commissioner sole authority to bring action for trespass, thus doing away with the divided responsibility now existing. Governor Higgins' message is a strong plea for recognition of the importance of for-

estry, and his recommendations are well brought out and strongly emphasized.

**North Dakota
Encourages
Tree Planting** An Act passed by the North Dakota State Legislature, and approved by the Governor February 28, allows an annual deduction of \$3 in taxes for each acre planted in any kind of trees, set not more than 8 feet apart, in real estate holdings of 80, 120, or 320 acres. Where persons plant trees suitable for hedge in rows along public highways, or upon their own premises, at the rate of more than two trees to each rod, they will receive or have deducted from their taxes annually a bounty of \$2 for every eighty rods of each row in length. This applies only in periods of less than five years for each particular row. Persons wishing to secure the benefit of this measure are required to file with the county auditor or clerk in their county a diagram or plat of the trees planted, and must make oath, together with two freeholders residing in the near vicinity, that the trees have been properly planted and cultivated, and that the diagram submitted is correct. Railroads planting trees within two hundred feet of their track or trees planted on land held under the Timber Culture Act of the United States are not included in the act. Section 4 of the act directs the duty of each assessor to the act, and outlines their method of procedure in allowing the claim.

**New Hampshire
Forest Fire Law** To better protect the forests of New Hampshire from forest fires, the legislature of that State has recently passed a new fire law. Fire wardens are created, and their duties outlined. Among the most important of these is the requirement that, upon direction of the Forestry Commission, they shall patrol forested areas, and post warning notices and extracts of the forest fire law. The warden is vested with the right to arrest, without warrant, all violators of the measure. "Reasonable compensation" is allowed for services of persons, or prop-

erty, used by the fire warden, and it is made an offense punishable by fine to ignore the warden's call for assistance, either personally, or in their use of wagons, tools, etc. The chief of the fire department in such towns as have such an organized department is designated as fire warden for that town, and where no such department exists, the Forestry Commission will appoint one of the Board of Selectmen to that position. Their compensation is to be paid for by the towns themselves, and at the regular salary they are ordinarily paid as members of the fire department or as selectmen. A severe fine is provided for any fire warden who neglects or refuses to perform his duties, and a section provides that, upon application of owners of forest lands in unorganized towns, special fire wardens may be appointed by the Forestry Commission, which board also fixes their salary. One-third the cost of these is borne by the owners, one-third by the township, and the remaining one-third by the State. It is also provided that persons discovering a forest fire must extinguish it, or report its location immediately to the fire warden, or be liable to a fine.

Indiana Protects Its Forests

The Dausman bill passed by the Indiana legislature, is designed to protect forest lands in Indiana, after nine sections providing that one-eighth of any farm used for forestry purposes under the direction of the Bureau of Forestry, should be exempt from taxation for twelve years, had been stricken out. The act passed provides a maximum fine of \$50 for any person who sets fire to any woods belonging to another, or allows fires from his own land to spread to woods owned by others. It also empowers the road supervisor to employ aid to extinguish fires which started in his district.

To Save Washington's Forests Representative Irving's bill in the Washington legislature, introduced on Feb. 23, and providing for the creation of a State Board of

Forest Commissioners, a fire warden, and a forester, and later passed, will have the effect of safeguarding more closely the forest wealth of that Pacific Coast State from the destructive forest fires of recent years, and the almost equally destructive ravages of lumbermen with the slogan "cut clean." The State Forester is to have a salary of \$1,800 a year, but the Board of Commissioners serve without compensation. A chief fire warden is provided for, and the board has the power to appoint special deputy fire wardens, to serve in such sections of the country as in their opinion require especial supervision and care. Washington already has a law requiring spark-arresters on engines, etc., in forest lands, but there has never been a rigid enforcement of the act, but in the measure passed, the fire wardens are specially directed to see that all laws promulgated are respected, and to arrest and convict violators. Persons refusing assistance in fighting forest fires, when called upon to do so by wardens or deputy wardens, are liable to a fine. All State land cruisers are constituted *ex-officio* forest rangers, and supplementary rangers may, in addition, be appointed by the board. All such wardens, rangers, deputy rangers, and police officers are empowered to make arrests without warrant. Persons setting fire to forest lands not their own, or who start dangerous fires near forest lands during the closed season are liable to arrest and conviction. A direct appropriation of \$25,000 is made for carrying out the provisions of the act.

Fight to a Finish

One rarely sees more forcible evidence of a prolonged battle for existence and its final outcome than that of the live oak and grapevine shown in the accompanying illustration, which is from a photograph recently made in the coast region of North Carolina by Mr. Romeyn B. Hough, publisher of "American Woods."

Here is a sturdy live oak, perhaps

centuries old, and beside it in days a grapevine started its existence. Little by little it extended its branches up and finally reached the oak. In course of time it

for its trunk had attained the unusual size of nearly a foot in thickness. This size is also evidence that it was winning the victory, as is further attested by the fact that it had partly killed the



Photo by Romeyn B. Hough

Illustration of a Finish Fight Between a Live Oak and a Grape-Vine in a North Carolina Forest.

ped it, appropriating to giving sunlight for which so striving. How it must have continued to grow of the vine,

tree. But one of its massive folds near the base had become involved in the crotch of the tree which gradually closed in upon it, constricting it, as though with monstrous jaws, until

it has nearly killed the vine. It is only a question of a little more time when its destruction will have been complete and the tree will again revel in its full measure of coveted sunlight.

Vermont's Forest Legislation

In a bill entitled "An Act relating to the preservation of the forests," and another "to encourage planting and perpetuating forests," Vermont has two new measures, passed at the latest session of its legislature, which should help a great deal to encourage the practice of forestry within its boundaries. The first act provides for the selection of a Forestry Commissioner by the Governor from the Board of Agriculture, and constitutes the first selectman in each town as a forest fire warden in his own town, with compensation during the time he is employed at the same rate he is paid for his other official duties. He is authorized to employ help in fighting forest fires at the rate of fifteen cents an hour and may demand the assistance of all townspeople in extinguishing the same, there being a penalty provided for persons refusing to do this. Should a town require more than five per cent. of the amount on its grand list for the extinguishment of fires in one year, the balance is to be paid for out of the State treasury. Penalty is fixed for persons who leave camp fires unextinguished, and parties kindling fires for brush-burning, etc., are warned to exercise care in starting and controlling them.

The Forestry Commissioner is to prepare forest fire warnings and notices and extracts of the law and have the same posted, and will prepare, or have prepared, bulletins and circulars treating of forest fires, their prevention, best methods of controlling and extinguishing, care of forest lands, best methods of lumbering, and in general diffuse a practical knowledge of forestry.

The second act exempts from taxation all waste or uncultivated land within the State which shall be planted with timber or forest trees under reg-

ulations issued by the State Forestry Commissioner, and in accordance with his directions. The Commissioner is directed to prepare such regulations in regard to the number of trees per acre, species to be planted, time of the year when such planting shall be done, etc., and must keep a record and make report of such exemptions.

The first act is not quite as complete and comprehensive as might be desired, but the second is a most excellent move, and by offering to owners of uncultivated or waste lands an inducement to plant trees will undoubtedly have the effect of reforesting for the future much of the worthless land of the State, with a crop that is constantly increasing in value.

New Jersey Forest Legislation

A bill was introduced in the New Jersey legislature by Mr. Alexander R. Fordyce, jr., and later passed by that body, providing for the appointment of five commissioners for the examination into the advisability of creating State forest reserves, and to recommend methods of their acquirement and administration by the State, and suggesting protective legislation. This commission is to make a complete printed report to the next legislature.

A second act, introduced also by Mr. Fordyce, on February 7, and which recently passed both houses and was signed by the Governor, thereby becoming a law, is even more indicative of the fact that the people of New Jersey are just now realizing what forestry means, and the beneficial results which State action will bring. The act creates a "State Board of Forest Park Commissioners," of which the Governor and State Geologist are *ex-officio* members, and to which is confided the reforestation of denuded lands, prevention of forest fires, administration and care of the State forests on the principles of practical forestry, coöperation with private owners of woodland, and encouragement in the preservation and growing of timber for commercial and manufacturing

several centuries old, and beside it in early days a grapevine started its existence. Little by little it extended its octopus-like branches up and finally over the oak. In course of time it

for its trunk had attained the unusual size of nearly a foot in thickness. This size is also evidence that it was winning the victory, as is further attested by the fact that it had partly killed the



Photo by Romeyn B. Hough.

Illustration of a Finish Fight Between a Live Oak and a Grape-Vine in a North Carolina Forest.

nearly enveloped it, appropriating to itself the life-giving sunlight for which the live oak was also striving. How long the struggle must have continued is shown by the great size of the vine,

tree. But one of its massive folds near the base had become involved in the crotch of the tree which gradually closed in upon it, constricting it, as though with monstrous jaws, until

it has nearly killed the vine. It is only a question of a little more time when its destruction will have been complete and the tree will again revel in its full measure of coveted sunlight.

Vermont's Forest Legislation

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purposes, and the general conservation of forest tracts around the headwaters and on the watersheds of all water courses. The board is to publish popular bulletins on the subject of forestry, for distribution, and make reports and recommendations. The State reservations may be acquired by deed, gift, or devise, or condemnation proceedings, and the board has power to acquire a fee simple estate to lands to be taken as reservations.

The act further provides for the appointment by the commissioners of fire wardens, and make it a misdemeanor to set fires on or near State forest reservations, or cut timber thereon, except when empowered by the board. Provision is made for the board to cut and sell State timber when it appears advantageous.

The three appointed members of the board serve without compensation, but with expenses paid by the State when in pursuance of their duties. A secretary of the board is created, with a salary to be fixed, who attests expenses and certifies amounts to be expended from the State moneys for the purchase of reservations.

The passage of this act marks a new epoch in forestry in New Jersey, a result of a liberal campaign of education that has led to understanding and appreciation, and a single law covering in so thoroughly comprehensive a manner the whole subject has seldom been enacted by a State legislature.

Appointments, Transfers; Reclamation Service Mr. John T. Keenan, of Colorado, has been appointed Assistant Engineer in the Reclamation Service. Mr. Keenan will engage in work on the Uncompahgre Valley project at Montrose, under the direction of I. W. McConnell.

Supervising Engineer B. M. Hall, who has had general charge of the investigations in the Rio Grande Valley in New Mexico and Texas, has been appointed Supervising Engineer for the Territory of Oklahoma, and will direct the operations of a number of field parties engaged upon surveys in

that territory. Mr. Hall will also continue in charge of work on the Rio Grande.

Mr. Willis T. Turner, topographer, has been assigned to duty in Montana, and ordered to report to Mr. S. B. Robbins, who has charge of the Sun River project in that State. Mr. Turner has been in the employ of the Geological Survey since 1894, in various capacities on surveying. He was assigned to the Reclamation Service in 1903.

Mr. John C. Cleghorn, of Iowa, has received an appointment as Engineering Aid and ordered to report to S. B. Robbins, Great Falls, Montana, where he will be engaged in work on the Sun River project.

Mr. Frederick H. Tillinghast, Assistant Engineer, has been assigned to duty in Washington. Mr. Tillinghast made a special study of hydraulics and sanitary engineering in the Massachusetts Institute of Technology, and graduated from Brown University with the degree of C. E. He has held various positions as assistant supervising engineer on construction work for railways and power companies, and in 1902 was appointed to the position of assistant engineer in the Reclamation Service.

Mr. Clifford M. King, of Ithaca, New York, has received an appointment as engineering aid and has been assigned to duty in Idaho. Mr. King is a graduate of the College of Civil Engineering, Cornell University, and has been engaged in construction work on concrete roadbed and railroads, and last season had charge of the location of canal lines for the Deschutes Irrigation and Power Company, in Oregon.

Mr. Thomas H. Humphreys has been promoted from the position of Assistant Engineer to that of Engineer. He has been assigned to work at Klamath Falls under Supervising Engineer J. B. Lippincott. Mr. Humphreys is a native of Idaho and graduated from the Utah Agricultural College.

APPOINTMENTS TO THE FOREST SERVICE

Method to be Followed in Selecting Men for Government Forest Work

ON December 17, 1904, the President signed the following order: "In the exercise of the power vested in the President by section 1753 of the Revised Statutes and acts amendatory thereof:

"IT IS ORDERED, That all persons employed in the field and in the District of Columbia in the 'protection and administration of forestry reserves in or under the General Land Office of the Interior Department' be classified and the civil service act and rules applied thereto, and that no person be hereafter appointed, employed, promoted, or transferred in said service until he pass an examination in conformity therewith, unless specifically exempted thereunder. This order shall apply to all officers and employees, except persons employed merely as laborers, and persons whose appointments are confirmed by the Senate."

This order classified the whole forest reserve service, and placed it under the civil service law. On February 1, 1905, by Act of Congress, this service was transferred from the Department of the Interior to the Department of Agriculture, without modification of the above order except in the further restriction entailed by the following section of the act:

"Sec. 3. That forest supervisors and rangers shall be selected, when practicable, from qualified citizens of the States or Territories in which the said reserves, respectively, are situated."

By order of the Secretary of Agriculture, dated February 1, 1905, the whole forest reserve service was placed in the Forest Service, under

the direction and control of the Forester.

POSITIONS IN THE CLASSIFIED FOREST SERVICE. PRESENT ORGANIZATION.

The field force of the Forest Service now contains the grades of Forest Inspector, Forest Supervisor, Forest Assistant and Forest Ranger.

The position of Forest Inspector is filled only by the promotion of experienced men already in the classified forest service. Forest Inspectors are assigned to inspection upon forest reserves, or in other branches of the forest work.

Forest Supervisors are appointed by promotion from Forest Rangers or Forest Assistants and by competitive examination only when no Forest Rangers or Forest Assistants in the State concerned are qualified and available for promotion to Forest Supervisor. They are assigned to the charge of one or more reserves, and now receive from \$1,000 to \$2,000 a year.

Forest Assistants are appointed only by competitive examination and may be assigned to reserve duty or to work in other branches of the forest service. They receive from \$900 to \$1,400 a year.

Forest Rangers are appointed only by competitive examination and are assigned to police and patrol duty upon forest reserves and to conduct the business of the reserve under the direction of the Forest Supervisor. Forest Rangers now receive from \$720 to \$1,080 a year, or \$60 to \$90 a month.

PROPOSED ORGANIZATION.

The reorganization of the forest service will take place as the neces-

sary funds, and as men of the required training and experience, become available. The position of Deputy Forest Supervisor will be added, the position of ranger will contain the grades of Forest Ranger, Deputy Forest Ranger, and Assistant Forest Ranger, and salaries will be fixed as shown below:

Forest Supervisor, \$1,800 to \$2,500 a year; Deputy Forest Supervisor, \$1,500 to \$1,700 a year; Forest Ranger, \$1,200 to \$1,400 a year; Deputy Forest Ranger, \$1,000 to \$1,100 a year; Assistant Forest Ranger, \$800 to \$900 a year.

EXAMINATIONS.

In accordance with the law requiring selection of Forest Rangers and Forest Supervisors, when practicable, from the states in which they are to be employed, regular examinations for these positions are held as required in each State and Territory in which forest reserves are situated. These examinations are along practical lines and include tests in the actual performance of field work. Only legal residents between the ages of twenty-one and forty are eligible for Forest Ranger or Forest Supervisor. Applicants are examined as to fitness for positions in the state or territory of which they are legal residents. Only when examinations fail to secure thoroughly qualified men are vacancies filled by the examination of applicants from other states.

The restriction as to residence is not imposed upon applicants for the Forest Assistant examination, for which the age limit is twenty years or over.

Information as to the times and places at which examinations will be held, and the steps necessary to secure admission, may be obtained only from the U. S. Civil Service Commission, Washington, D. C.

GENERAL QUALIFICATIONS AND DUTIES. FOREST SUPERVISORS.

For the purpose of encouraging good men to enter the service and to do good work, as well as to utilize

their experience, appointments to the position of Forest Supervisor are made by the promotion of competent Forest Rangers or Forest Assistants, when the latter can be found in the States or Territories in which the vacancies exist. Should there be no thoroughly satisfactory resident, Forest Rangers or Forest Assistants, examinations of other applicants are held.

The qualifications for the position of Forest Supervisor include all those required of Forest Rangers, as hereafter outlined, with superior business and administrative ability. Applicants should not only be familiar with every detail of the work of the rangers and with the conditions of the forest region involved, but able to handle men, to deal with all classes of persons who do business with the forest reserve management, and to conduct the transactions, records and correspondence of the office. Knowledge of technical forestry is desirable but not essential. Candidates for the position of Forest Supervisor are required to furnish the most convincing proof of their moral and business responsibility.

While certain general qualifications are insisted upon in every case, special fitness for employment in a specified region is always considered. In many heavily forested regions knowledge of timber and lumbering is more important than familiarity with the live stock business, while the opposite is true in several interior reserves where grazing problems are numerous and little, if any, timber is sold.

Forest Supervisors must give their entire time to the service. They have full charge of their reserves, plan and direct all work, have entire disposition of rangers and other assistants, and are responsible for the efficiency of the local service. Under instructions from the Forester, Supervisors deal with the public in all business connected with the sale of timber, the control of grazing, the issuing of

permits, and the application of other regulations for the use and occupancy of forest reserves. They keep the records and accounts, and conduct the correspondence and general office business of their reserves, and make reports to the Forester on all matters under their jurisdiction.

FOREST ASSISTANTS.

The position of Forest Assistant requires technical qualifications of high order, and entails an examination which no man may reasonably expect to pass unless he has been thoroughly trained in scientific forestry, dendrology, and lumbering. Forest Assistants may be assigned to any part of the United States and must be competent to handle technical lines of work, such as the preparation of working plans and planting plans, the investigation of the silvical characteristics and the uses of commercial trees, the study of problems in wood preservation, and to conduct many other investigations requiring a trained forester.

FOREST RANGERS.

To be eligible as Forest Ranger of any grade, the applicant must be, first of all, thoroughly sound and able-bodied, capable of enduring hardships and of performing severe labor under trying conditions. Invalids seeking light out-of-door employment need not apply. No one may expect to pass the examination who is not already able to take care of himself and his horses in regions remote from settlement and supplies. He must be able to build trails and cabins, and pack in provisions without assistance. He must know something of surveying, estimating and scaling timber, lumbering, and the live stock business. On some reserves the Forest Ranger must be a specialist in one or more of these lines of work. Thorough familiarity with the region in which he seeks employment, including its geography and its forest and industrial conditions, is usually demanded, although lack of this may be supplied

by experience in other similar regions.

The examination of applicants is along the practical lines indicated above, and actual demonstration, by performance, is required. Experience, not book education, is sought, although ability to make simple maps and write intelligent reports upon ordinary reserve business is essential.

Although initial appointment as Forest Ranger is usually to the lowest grade, in case of merit service therein may be only for a short probationary period. Increase of salary above the maximum for a Forest Ranger can be secured only through promotion to the position of Deputy Forest Supervisor or Forest Supervisor when a vacancy occurs. It is the policy to fill such vacancies by promotions of Forest Rangers or Forest Assistants, when competent men can be found, rather than by appointment of men without forest reserve experience although otherwise well fitted.

Where boats, saddle horses, or pack horses are necessary in the performance of their duty, rangers are required to own and maintain them.

The entire time of rangers must be given to the service. Engagement in any other occupation or employment is not permitted. Forest Rangers execute work of the forest reserve under the direction of the Forest Supervisor. Their duties include patrol to prevent fire and trespass, estimating, surveying and marking timber, and the supervision of cuttings. They issue minor permits, build cabins and trails, enforce grazing restrictions, investigate claims, and arrest for violation of reserve laws.

FOREST GUARDS EMPLOYED DURING FIRE SEASON.

In addition to the permanent classified force which comprise the Forest Service, temporary assistants are employed during the season of serious danger from fires. These are known as Forest Guards, and may be employed or dismissed by the Forest Super-

visor at any time. They are paid at the rate of \$50 to \$60 a month, and serve only as long as they are absolutely required; in no case over six months in any one year.

No examination is required of applicants for employment as Forest Guard. They are hired by the Forest Supervisor when fire patrol or other special work requires addition to the regular reserve force, and he is responsible for their satisfactory service.

Applications must be made to him direct. He will require sobriety, industry, physical ability, and effectiveness, and will give preference to local residents of whose fitness he is fully satisfied. He may direct their work himself or place them under the supervision of a ranger.

The position of Forest Guard should not be confused with the existing grade of third-class ranger, which now carries the same salary.

FOREST CONDITIONS IN NORTHERN NEW HAMPSHIRE

Results of an Examination in the White Mountain Region

ALL that part of New Hampshire which lies north of Squam Lake and east of the lowlying agricultural lands along the Connecticut river is almost entirely forest covered, and for the most part will always be most valuable under forest growth. It contains 32 per cent of the total area of the State, or nearly 2,000,000 acres.

In the winter of 1903 the State legislature appropriated \$5,000 for an examination and study of this region by the Bureau of Forestry. A full report on this work has been prepared, and will soon be published by the Bureau. It includes a description and estimates of the forest, by drainage basins, an account of the characteristics of all important timber trees, a careful discussion of forest fires and their effects, and a study of the lumber, paper pulp, and other State industries dependent upon the forest.

The region studied constitutes two classes, which differ considerably both in general character and in forest growth. The southern of these is the White Mountain region, which contains approximately 812,000 acres. It is very rough and rugged, with numerous broken mountain ranges inter-

sected by deep, narrow valleys, with steep slopes, rapid streams, and all the conditions which invite soil erosion and permanent denudation of forest growth on the higher slopes, if careful lumbering is not practiced and fire is not kept out. In the extreme southern part of this region second-growth white pine forms a valuable part of the forest on the lower lands, but spruce is in general the leading commercial species. Before lumbering began spruce was much more common than now, and the effect of present methods is still further to decrease its representation and to substitute for it the hardwoods, which are usually of much lower commercial value.

The region north of the White Mountains is characterized by hills or low mountains and wide valleys, and contains many lakes. Here the spruce and balsam form a greater proportion of the forest growth than in the White Mountain region. While the greater part of this area has been cut over the lumbering has not been so intensive as in the White Mountains, but has consisted chiefly in culling out the best spruce, pulp wood of small di-



Scrubby Balsam at an Elevation of 4,800 Feet on Mount Madison, New Hampshire.



Dense Stand of Balsam on a Spruce Bog, Logged Fifteen Years Ago.



Virgin Spruce with Dense Balsam Reproduction on Mount
Jackson, New Hampshire.



Second Growth Spruce and Balsam, Near Pittsburg,
New Hampshire.

mensions not having been so extensively cut. As a consequence there is a great deal of small spruce and balsam on cut-over land. The region is admirably suited for continued timber production, and owing to its inaccessibility forest fires are not severe.

Until 1896 the greater part of the Mountain region was owned by the State. Since then the State has sold large and small tracts at nominal prices, until today all the forest land is in private ownership most of it held by large lumber and pulp companies. These companies are making formidable inroads upon the forests. Seven companies own nearly all the timber land, and three of them cut annually about 75,000,000 board feet, mostly from virgin forests. To this must be added the tremendous losses by fires. In 1903 nearly 85,000 acres were burned over, with a loss of over \$200,000, not including the very great damage to the young growth and to the productive capacity of the forest. It is a hopeful sign, that two of these companies have adopted the policy of conservative lumbering.

Of the total area examined, approximately 2,000,000 acres, 989,592 are covered with softwoods, 34,752 with pine, 455,112 with hardwoods, and 244,036 acres are agricultural lands: the remainder is made up of burned, waste and barren land, and lakes and streams. The virgin merchantable forests comprise but 200,000 acres, while there are 1,363,711 acres of cut-over or culled land, and 120,495 acres of barren and waste land. The present stand of softwoods is computed to be 4,764,000,000 board feet and the annual cut is 249,639,000 feet. In 1900 the wooded area of the entire State was 3,228,000 acres and the cut for lumber amounted to 570,357,000 board feet. This is equivalent to 177 board feet per acre of wooded

area, and is more intensive lumbering than in any of the big timber States, Wisconsin being next with 175 board feet per acre.

In relative importance in New Hampshire the lumber industry stands third, the paper industry fifth. From July 1, 1902 to June 30, 1903 the total amount of wood cut in the northern 562,000 board feet, of which 82.5 per cent., or 225,747,000 board feet was spruce. In the same year the paper and pulp mills used 109,041 cords of native spruce and 87,859 cords of Canadian spruce. The pulp companies are each year importing spruce in order to save their home forests as much as possible, and, by cutting them conservatively, to secure a continuous crop through natural reproduction. Lumber companies have not been so conservative; in many cases clean cutting has been the custom. The Bureau of Forestry recommends that all large lumber and pulp companies secure in their own interest as well as that of the region, the services of trained foresters to regulate the cutting.

The paramount forest menace, in New Hampshire as elsewhere, is fire rather than lumbering. But for the seemingly invariable rule that fire always follows lumbering, the cutting could and doubtless would be more conservatively done. The lumberman naturally argues: Why leave standing seed trees, or even trees of smaller diameter, only to be destroyed by fire? Thus while he is cutting he takes everything that he can sell, and leaves the young growth to take its unequal chance against fire. Let the State throw around the forests but a tithe of the fire protection furnished the business enterprises of its cities, and lumbering will immediately respond with methods adjusted to the better business risk.



North Sugar Loaf Mountain, New Hampshire. Once Heavily Timbered, But Now Practically Barren, as a Result of Clean Cutting and Fire.



Young Conifers Killed by a Severe Ground Fire.



First Connecticut Lake, New Hampshire. Effect of Constant Flooding for Storage.



Barren Upper Slopes of the Presidential Range. New Hampshire.

THE SANDALWOOD TREE IN HAWAII

BY

C. S. JUDD

IF any tree has ever been grossly maltreated it is the sandalwood tree in Hawaii. Of no especial value at first to the natives of the islands it grew naturally and abundantly in splendid mountain groves, but today only a few survivors are found in isolated parts of the country. The same avarice and human lack of foresight which swept away the American buffalo by the thousands has also been active in almost completely extirpating this tree in the Hawaiian Islands.

Of the three species of the sandalwood and about four varieties which grow in the islands, those most commercially important were the *Santalum freycinetianum* and *Santalum pyrularium*. These were straight, handsome trees attaining an average height of twenty-five feet and a thickness of one foot at the base. Another variety is reported to attain the height of eighty feet with a trunk three feet in diameter, while still other varieties were mere bushes growing along the rocky shore or in the inaccessible highlands. The wood of each species was compact, fine-grained, and of a yellowish color. On account of its remarkable fragrance it was called by the natives *laau ala* (odoriferous wood), while the name of the tree itself is *iliali* (fire bark). In China it was purchased by the picul of 133½ pounds, the price varying from eight to ten dollars for the picul. Today genuine sandalwood is worth in China from \$60 to \$190 a ton. In that country there was a great demand for the wood where it was and is still used for ornamental carving, framework for fans, for perfumes and as incense in Buddhist temples. It is especially valuable for cabinet work for insects are repelled by the spicy odor of the wood.

The traffic in sandalwood marked the first commercial period in the history of the Hawaiian Islands. In some way the presence of the tree was suddenly discovered by early voyagers who knew its value and it seems to have been American ships that instituted the trade, for in 1792 two men were left from a Boston brig on the island of Kauai to contract for several cargoes of sandalwood for the China trade. The chiefs sent their serfs into the forests to fell the trees, clean the wood and bring it down by shiploads to the sea. At first all commerce was carried on by barter and in return for large cargoes of this wood the chiefs received, in less value, trinkets, guns, ammunition, liquor, boats, silks and other Chinese goods. Great quantities of the costly goods, however, were never used but, being stowed away in unsuitable and insecure store-houses, were allowed to decay. In their greed for gain the chiefs, who had complete control over the common people, oppressed them sorely, compelling them to remain for months at a time in the mountains felling trees and bringing them down on their backs to the royal store-houses situated on the shore.

About the year 1810 Kamehameha I, king of Hawaii, is said to have received annually \$400,000 for sandalwood and during the closing years of his reign and until 1825, the trade in this valuable wood was at its height. In 1829 the wood was becoming scarce and in 1835, the annual export had fallen off to \$30,000. In the years from 1836 to 1841, it amounted to only \$65,000, and soon after the trade in sandalwood seems to have come to a complete stop.

The cause of this rapid decrease and final termination was due to the un-

relenting chiefs who were guilty of the almost complete extinction of this valuable asset to the island forests. So harshly did they drive on the serfs in the gathering of the crop that these oppressed people destroyed also the young trees, in order that they and their sons might be relieved from toil, so heavy in the years to come. Shortly after, 1840, the chiefs suddenly realized their blunder and the taboo which they then put on the trees has saved for us a few species in the deep woods.

In India to-day a similar species, the *Santalum Album*, is successfully cultivated, under government control, and the supply of the wood is kept up by large plantations. The trees attain their maturity in twenty to thirty years, the trunk then being one foot in diameter. It is to be hoped that on the new forest reserves of Hawaii attempts will be made to restore the groves of this valuable tree and we may yet live to hear that the trade in sandalwood, grown in the Hawaiian Islands, has been revived.

FORESTRY IN NEW YORK STATE

BY

J. Y. McCLINTOCK

WHILE there are many persons who are scattered throughout the country convinced of the wisdom of establishing public forests, there are few in any one community knowing enough about the subject to form an intelligent opinion; and yet any action by the authorities in that direction must be sustained by public opinion. Therefore I desire to present some points in connection with the problem in New York State, and ask for an expression of opinion by this convention, knowing that it will have great weight with our citizens.

The people of New York have long been convinced that its forests should be preserved and that its hills and mountains which have been denuded should be reclothed with woods. Each political party favors it and there has been no adverse criticism of the expenditure made during a few years for the purpose of beginning the work.

The State is practically out of debt, and is being run without appreciable direct taxation. There are few places where intelligent forest operations will be beneficial to so large a number of people, or to so large an aggre-

gation of invested wealth. It is impossible to explain why in the interest of the people the great Empire State, after making a good start in the direction of purchasing the forest lands, should suddenly stop, while that which it already owns is being neglected, and that which it will be necessary to buy, is continually advancing in price or being ruined by burning, after every growing tree has been removed by the wood alcohol and charcoal manufacturers, following after the lumbermen, tanners, and pulp men.

The subject has been treated in such a way, that the public are led to believe, that either the friends of forestry are not convinced by their own arguments, or that the department is not able to handle so large a business. The State began to buy forest land, and secured several hundreds of thousands of acres, at prices which seemed reasonable to all men conversant with the subject, and yet the appropriations were cut off and the work stopped. The State assisted in establishing a school of forestry the importance of which cannot be overestimated; and at the first

little puff of adverse criticism of its methods the appropriations were withdrawn and the school was closed.

The present State holdings of land are so scattered and interspersed with private holdings, that it is obviously impossible, at any reasonable cost, to apply intelligent forestry methods to them, or protect them from lumber thieves and forest fires.

It is probable that the land now owned by the state in the Adirondacks, about 1,250,000 acres, has a frontage of fully 10,000 miles upon private lots ranging in size from 40 acres to 90,000, whereas, if it was consolidated, the length of boundary might be reduced to 200 miles. When one remembers that but a very small part of this long line is plainly marked, and on one side of it is State woods or brush, and on the other side of it hundreds, if not thousands of men are cutting timber and wood and burning brush, it does not seem strange that the department is unable, with the appropriations available, to protect it.

The difficulty is also immensely increased by the provision of the Constitution prohibiting the cutting or removal of any trees from the State lands. When this was put into the Constitution the public did not have confidence in the forest officials, and the condition reminds us of the natural and divine law, that the sins of the fathers shall be visited upon the children, even unto the third and fourth generation. It is earnestly hoped that before many years the New York State forestry department will be organized on such a basis as to command the confidence of the community, to the extent of permitting the removal of this provision of the Constitution.

The time has come when the forest problem of New York State should be taken up boldly, and solved on the broadest scale. Every community and every citizen has a vital interest in it.

The protection of the sources of

water supply to our cities, the increase of the value of our beautiful streams and rivers for navigation, development of power, and propagation of fish, the establishment of the most enjoyable health and pleasure resorts, within reach of the common people, and the permanent maintenance of countless industries, ministering to the need and comfort of all, depend upon the proper solving of this problem. The forest work should be spread over the entire State, so as to bring it in contact with the largest number of citizens, whose opinions and votes must sustain it.

There are sixty-one counties, in all of which, excepting five or six, there should be a State forest. In some it would cover the larger part of the county, while in others it might not exceed 1,000 acres. All lands not fitted for agriculture or profitable grazing, whether in the Adirondacks or the Catskills, or the foot hills of the Alleghanies, or on the shore of Long Island, should be under proper forest management.

The watersheds where the water supplies for the great cities are collected, should, as far as possible, be covered with forests. While Philadelphia is expending huge sums for filtering its water supply after it has been contaminated, and other cities are forced to do the same, it appeals to our common sense that where it is possible, it would be better to collect the water from forest clad slopes rather than from highly cultivated farming land. For this reason the most attractive source for the additional water supply to New York is the Catskill region, where a great forest can be most advantageously established and maintained.

The city of Rochester which takes its supply from Hemlock Lake in Livingston and Ontario counties has expended hundreds of thousands of dollars in purchasing a strip of land all around the lake and has begun to set out forest tree seedlings to start a forest on its big plantation. It has

also started a protecting forest around its secondary reservoir in Monroe county. It will be found advisable to protect with more or less forest, Skaneateles Lake, supplying Syracuse; Conesus Lake, supplying Geneseo and Avon, and other lakes supplying cities.

Even in the rich agricultural counties, there will always be a local demand for wood and timber, and there are waste areas, and exhausted tracts, which could well be put into forests, for the purpose of supplying the local demands, and do away with the necessity of wood lots on each farm which are run usually in a wasteful manner and occupy too valuable land.

These small forests would afford the most attractive recreation areas for the neighboring localities, and after two or three generations they could be turned back to agricultural use, when new soil will have been formed. The plan followed in New York has been to confine the State forests to an area of about three and one-quarter million acres in the Adirondacks and a few hundred thous-

and in the Catskills. This should be enlarged so as to make the limit to be striven for, include all of the unimproved or forest land in the State.

This would comprise more than 10,000,000 acres of which about 6,000,000 would be in one great body, lying in thirteen counties, covering the Adirondacks, including Lake George, the west shore of Lake Champlain, Lyon Mountain, and excepting the lower Black river valley proper, include the great forest in top of Tug Hill, between the Black and Mohawk rivers.

Another great forest would comprise about 1,500,000 acres lying in five counties and covering the Catskills and Helderbergs, and still another would comprise about 1,250,000 acres lying along the southern boundary of the state in seven counties.

In addition to these there might be 1,250,000 acres distributed amongst thirty counties, in forests ranging in sizes from 2,000 acres in the rich county of Wayne to possibly 300,000 acres in Suffolk including the sandy shores of Long Island.

ECONOMIC METHODS IN RESTOCKING WHITE PINE FORESTS

BY

F. WILLIAM RANE

Professor of Horticulture and Forestry, New Hampshire College

THE white pine probably has played as important a part in lumbering interests as any tree that is indigenous to the country. As the primeval forests of this valuable timber are rapidly disappearing and hence, prices proportionately rising, the natural consequences are that problems of economy, not only in the use of the present supply but methods of renewal toward growing similar crops for the future are dawn-

ing. When anything reaches the stage that money valuations become stranded and of recognized importance we then have a basis for building financial structures. The greatest trouble in the past as regards forestry and its economic importance has been the problem of definite values. Today even pine box boards have a standard value of about \$14 per thousand feet board measure in New England. Square edged boards of

fair quality did not bring more than this amount not many years since.

When the writer began the study of economic forestry as adapted to New England a few years since it was quite a perplexing problem. Nowhere could be found definite data or experienced foresters that could give the sort of information desired. Every-

ceived that such an undertaking was not practical. In the face of this discouragement and at private expense such work was, however, begun and has met with pronounced success.

In 1900 the writer endeavored to find out where seeds and seedlings could be purchased in quantity and at



Digging White Pine Seedlings.

thing that has been published until very recently has been of a general nature and evidently not backed by results from actual forest work carried on in America. Even when requesting assistance from the Bureau of Forestry in carrying on experiments in restocking waste lands as late as 1901, information was re-

minimum cost. Two dollars a pound for pine seed was found a good average price, and three dollars a thousand for four to six inch seedlings was the lowest quotation secured, plus packing and freight charges. Nowhere in New England could seedlings be obtained at this time and for a few hundred thousand lots the or-

der went to Illinois. Think of its being necessary to send hundreds of miles to get pine seedlings, to the prairies of the West where they grow only in nurseries and hence artificially, when this tree is indigenous and propagates itself, it allowed to do so, in New England. One of our American foresters advocated purchasing pine seedlings direct from Germany as the most feasible plan at the time.

The amount of seed recommended by best authorities was five pounds per acre. The purchase of seedlings from Illinois proved as successful as anything that could approach an economic standard at the time. The idea of sowing ten dollars worth of seed on an acre of land that has a valuation ranging from fifty cents to five dollars was not considered practical. The transportation of seedlings from so far west has its drawbacks not only from the standpoint of extra expense but the risks in shipment, which are many.

After much study of forestry conditions and experimentation toward doing something that will be of actual economic benefit, especially in New England, I am convinced that results will be followed generally only where simple, well defined, tested practices have proven to be successful.

Upon careful examination the writer has found in different sections where the white pine is native, young natural seedlings in large numbers, and it is to emphasize the importance of utilizing these resources already at hand and to point out results from experiments in utilizing them that this paper has offered.

Seedlings of varying ages can be easily transplanted and be made to live if care is exercised and they are handled early in the season. Those we have found to be the most economical to use have been from two to four years of age. Data upon digging and transplanting these native seedlings at the New Hampshire College has been recorded at various times, but the best and most reliable

information to offer is the cost of digging and transplanting 22,000 seedlings the past spring. Many of the students at the New Hampshire College help defray their expenses while attending the institution and it was these boys who did the work under the supervision of one of their own number, Mr. Wesley P. Flint, who is specializing in forestry. The work of digging was begun on April 18th and the seedlings were dug in various localities about Durham. The best method for digging was found to be by the use of the nurseryman's hoe, a two tined hoe resembling in some respects the potato digger. By the use of this tool one man can loosen about as many as two men can pull or pick up. One quick man can follow fairly well. These seedlings need a little care in lifting, however, after being loosened by the hoe. Where they have grown in sod ground as is often the case in the meadow at the edge of the woods one man can loosen as many as three men can pick up as they should be handled. It sometimes happens, however, where seedlings are growing in fine, deep, rich leaf mould, if gathered at the right season, they will come up as rapidly as one can pick them, so easily do they free their roots from the soil.

A man can hold about twenty-five trees in his hand easily and when this number has been pulled they may be put in small piles or baskets, protecting the roots from the sun. Averaging all conditions which varied from sod to those grown in leaf mould, each man averaged from 175 to 250 trees per hour. It is a safe estimate to say that seedlings of three years of age can be dug for about 75 cents per thousand.

Packing: Where the trees are not to be shipped of course this item of expense is not reckoned. Where they are to be shipped, however, the best method we could devise was to use the ordinary Boston market bushel box. As shown in the accompanying photograph, they can be placed flat-

PURCHASE OF FORESTRY LANDS BY STATES AN INVESTMENT

BY

GENERAL C. C. ANDREWS

WHILE most of the forest in Europe is owned by individuals, nearly all of the European states separately own and manage considerable forest land, though not of course in one body. Amidst, though not a part of, these forests, are occasional farms, villages, and many people. The forests are generally traversed by good roads. Prussia owns 6,000,000 acres of state forest, from which it derives an annual net revenue of \$9,000,000. France owns 2,100,000 acres of state forest, from which it derives a net annual revenue of \$1.91 per acre.

Why should the state own forest? Because on light soil, unfit for agriculture, it takes on an average about eighty years for pine forest to grow to merchantable size, and individuals will not engage in the business on a large scale.

In 1897 the Forest Commission of Wisconsin employed Dr. Filibert Roth, an able forest expert, to examine the northern part of that state with a view to inaugurating a forest policy. In an area of 18,000,000 acres, which had produced pine timber, he found 6,000,000 acres which he reported, "Not at all suited to farming, or only doubtfully so, and which should by all means be left to forest."

The area of land in Minnesota which has yielded pine is, in the aggregate, 18,000,000 acres, and it may be assumed there are at least within this area as many as 3,000,000 acres of rocky, hilly, or sandy land that is unfit for agriculture and which should be used for forestry. It may be asked if the state does not now own enough land? The State of Minnesota now owns about 2,500,000 acres

of land, given by Congress, which by law it must sell, and for not less than \$5.00 an acre, for school and state institution funds. Besides, the greater part of these lands are suitable for agriculture. They cannot possibly be taken for forestry.

Saxony has 432,000 acres of state forest, the annual growth in which averages 225 feet board measure per acre, so that 97,000,000 feet board measure can be cut yearly for revenue without impairment of the capital. At the same rate of growth the 3,000,000 acres in Minnesota should, in eighty years, when it becomes a normal forest, begin to yield 675,000 feet board measure annually, and which, at \$5.00 per 1,000 feet, the present rate (the value will probably be double then), will be worth, standing in the woods, \$3,375,000 as net revenue.

In Germany, each 100 acres of forest gives steady employment to one workman, who lives in or near the forest with his family. He has skill and training, and, to be contented, must have good wages. In the same proportion, our 3,000,000 acres of Minnesota state forest would give steady employment to 30,000 workmen, who would represent an orderly population in the forest of 120,000. Among other indirect benefits, the forest would promote water supply in streams, beautify landscape, fertilize soil, ameliorate climate, afford covert for game.

One of the richest pine timber regions of the northwest was the Saginaw and Huron Shore district of Michigan. In 1893 there was cut in that district 858,000,000 feet of pine but the supply of pine timber had sc

diminished during the next ten years that in 1903 only 52,000,000 feet were cut.

The remaining original pine timber in Minnesota will be cut within the next fifteen years. There is some new growth coming on, and, while pine will always be cut in Minnesota, the great logging industry which now employs 15,000 men every winter will suffer a great decline.

The population of the United States increases 18 per cent every ten years, and the population of Minnesota increases more rapidly. The demand for forest products will increase. The Commissioner of Statistics estimates that there are in this state 12,000,000 acres of arable land not yet under cultivation. Cheap lumber will be an important factor in developing this land.

In 1897 the State of New York owned about 1,000,000 acres of forest in the Adirondacks, since which time it has purchased, through its Forest Commission, mostly in the Adirondacks, but partly in the Cat-

skills, 437,000 acres more, for which it paid \$1,697,448, being an average of from \$2.56 to \$4.26 per acre. January 1, 1903, it held 1,436,686 acres of "forest preserve." There remain 1,200,000 acres of forest land in the Adirondacks, which it is expected the state will acquire for \$2,000,000.

The Forestry Commission of Pennsylvania has purchased 700,000 acres of forest land at an average price of \$2.75 per acre, and is continuing the work. The purchase of land for forestry in both these states is properly regarded as an investment, and not as an expenditure.

The legislature of Minnesota, of 1903, authorized the Minnesota State Forestry Board to purchase land within the state, adapted for forestry, at not exceeding \$2.50 per acre, and preferably at the source of rivers, and to maintain forest thereon according to forestry principles, but appropriated no money for the purpose. It would be wise policy for the present legislature to make a suitable appropriation to commence this work.

BEST USE OF WASHINGTON'S STATE SCHOOL LANDS

BY

FRANK H. LAMB

THE man who squanders his own money suffers for his acts—he is rated a fool.

The manager who allows the assets of a corporation to become dissipated is soon discharged from the service of the company. He is a business failure.

The trustee of the legacy of a widow and minors who does not properly husband the properties entrusted to his care incurs the censure of the court and the everlasting anathemas of the wife and children.

The men who are not true to any

great trust imposed upon them for a specific purpose, wrong and injure not only the grantor and grantee of the trust, but if it be a public trust, injures the public, not for the present only but for all time.

The people of the United States through its representatives—Congress—granted to the people of Washington for all time for the support of the schools of the state certain tracts of the public domain. At the time of that grant the State of Washington contained less than 350,000 inhabitants.

Farm values were only about 25 per cent of what they are to-day. The value of stumpage or standing timber was practically nothing; it was a nuisance, an impediment to settlement of the land by farmers. These lands were granted to the state as a trust, the revenues from which were to be used for the support of the various institutions endowed. The legislature of the state is the trustee of that trust. It is a trust granted by the people of the United States to the people of Washington for the use of the school children of the state for all time to come.

Can it be supposed that Congress ceded these lands to the state expecting it to act as a broker or agent to immediately realize upon them by sale? Did the people of the United States suppose that Washington would sell these lands, as were the 64,080 acres of the original territorial grant to the state university, at \$1.50 per acre? Did Congress expect or intend that the State of Washington would sell the birthright granted to the school children of the state for a "mess of pottage," or was it the intention of Congress to make this grant to the new state, believing the people of the state would have a proper regard for the welfare of the school children and see that these lands were properly protected and managed and the resources husbanded so that the greatest possible annual return might be placed in the various funds?

Suppose the trustees of that magnificent institution, Girard College, had, upon the acceptance of their trust, disposed of the real estate holding of Stephen Girard, located in the city of Philadelphia, and many of which were apparently without any great value, for what they could have secured—do you think that the original endowment of \$1,000,000 would have grown to the enormous capital of \$30,000,000, the revenues of which that institution now disposes annually to orphan children? Suppose these trustees had not taken any steps to build up these properties,

to develop their latent resources—had allowed fire to destroy them—would Girard College be the second richest institution of learning in the world to-day?

The Legislature of the State of Washington is as much a trustee of the common schools as is the trustee of any other institution or the guardian of the person and property of the lone widow or helpless orphan children. Is it then not right that it should devote as much time, attention and conscientious business ability to the care and management of these lands as would any other trustee or business man?

SCHOOL LANDS GRANTED AND NOT DISPOSED OF.

The area of these grants and the acreage, not disposed of by sale, lease or contract, is as follows:

Name of Grant.	Original Grant. Acres.	Area not Disposed of. Acres.	Pct.
Normal Schools.....	100,000	68,428.29	.68
Agricultural College.....	90,000	60,671.91	.67
Scientific School.....	100,000	85,275.15	.85
Chart. Educat., Penal and Reform Insts..	100,000	88,923.08	.88
University, original..	46,080	587.29	.012
University Sub. grant	100,000	64,860.40	.65
Capitol.....	132,000	113,948.51	.86
Common Schools, Secs. 16 and 36, estmd..	2,250,000	1,353,958.00	.61
Totals.....	2,918,080	1,836,653.63	.625

There has been received from sales and leases of state lands in the past twelve years a total of \$5,140,254.82. This has been derived from deeded sales of .027 per cent of the state's lands, or 78,837.89 acres at an average of \$16.68 per acre; from sales by contract of .023 per cent of all lands or 68,368.47 acres at an average of \$19.83 per acre; and from lease of a total of 30 per cent of all state lands, or 888,651.38 acres, at an average annual rental of 14 cents per acre.

THE STATE TIMBER LANDS.

It is safe to presume that, of the state lands, those lying east of the Cascade Mountains include but little merchantable timber, while those west of that divide were selected mainly for the value of their timber.

The area of school lands originally granted, in each county west of the Cascade Mountains, is as follows:

County.	Acres Common School Lands.	Acres Granted Lands.	Totals.
Whatcom.....	27,631.00	1,512.23	29,143.23
Skagit.....	31,123.00	12,158.58	43,281.58
Snhomish....	36,921.00	6,666.32	43,587.32
King.....	48,251.00	24,135.84	72,386.84
Kitsap.....	17,909.00	1,120.00	19,029.00
Clallam.....	48,385.00	36,251.19	84,636.19
Jefferson.....	22,648.00	51,843.15	74,491.15
Chehalis.....	51,759.00	13,053.59	64,812.59
Mason.....	22,001.00	18,942.14	40,943.14
Pierce.....	27,016.00	15,135.10	42,151.10
Thurston.....	22,291.00	3,391.80	25,682.80
Pacific.....	35,636.00	20,236.54	55,872.54
Wahkiakum... 7,745.00	17,107.76	24,852.76	
Lewis.....	62,564.00	16,861.37	79,425.37
Cowlitz.....	38,661.00	35,469.24	74,130.24
Clarke.....	22,736.00	11,695.61	34,431.61
Skamania.....	15,189.00	15,987.38	31,176.38
	538,466.00	391,567.84	840,033.84

The area of the common school grant has been computed from the plats of the surveyed townships in each county with indemnity selections added and all sales to date deducted.

In the timbered counties above enumerated the state will receive for its common school grant, when all the lands are surveyed, approximately 847,360 acres. Any loss due to forest reserves, etc., can be selected in lieu lands elsewhere.

Taking the strictly timbered lands, it is the opinion of all timbermen that they are worth to-day, at a minimum valuation, \$10 to \$15 per acre, or \$8,-400,000 to \$12,600,000—certainly a most munificent endowment for our schools. Yet the aggregate sales of timber bills of sale issued in the past four years, comprising over 67,000 acres, has only averaged \$8 per acre for the timber, separate from the land.

WHAT CAN THE STATE DO WITH ITS TIMBER?

Only three plans have been suggested for the management and disposal of the state timber lands:

First. To retain absolutely all state timbered lands for a period of years.

Second. To allow the state land commissioner full discretion and power to sell any or all of these lands in fee simple at any time.

Third. To sell only the timber from the state lands and then only as need-

ed, with the condition that it be removed in a limited period.

If the state reserves from sale absolutely all timber lands it will lose all the timber standing on such portions of them as come within the scope of logging operations.

Over 60 per cent of the state lands are comprised in sections 16 and 36 of each and every township in the state. It is impossible in logging to avoid these sections. The logger is not going to allow the fact that one-eighteenth of the land is reserved by the state to deter him from beginning logging operations in any locality.

When these lands are reached and become accessible in the course of ordinary logging operations, if the state does not realize upon them it never will. With the surrounding lands cut over, fire will run over these isolated sections with each recurring season until little of value remains. Furthermore, if they escape the flames, the logger may in a few years cease his operations in that vicinity. Track and equipment reaching in value into hundreds of thousands of dollars will be removed and it will be financially impossible to ever replace them in order to reach these isolated school sections lying four miles from each other.

If an ironclad law is enacted and maintained reserving the state timber lands, the state would eventually get absolutely nothing for its timber inheritance.

Is this the policy a business man would adopt? Does the large timber land owner hold his scattered lands in the face of such conditions?

Were the state to offer its lands indiscriminately for sale to-day it cannot be denied but that in a very short time they would be absorbed by private owners. If an absolutely honest sale such as a business man would make should be made by the land commission, these lands might realize \$10 per acre, or over \$5,000,000. Certainly a mere pittance for the permanent endowment of our state schools. Companies owning large bodies of timber

lands would be forced to have these state lands appraised and they would buy them in to protect their other ownerships. As long as the state holds these lands no party has the advantage, but with an open market each dominant owner in any one locality would be forced to take in the school lands. While competition in their purchase would be nominally open to all, yet practically only those who own the major portion of the other eighteen sections or who already controlled the means of exit could bid anywhere near their real value.

Realizing as all must that the increase in realty and stumpage values is far greater than the interest upon the returns, if sold at a portion of its value, it follows that the state should not dispose of one acre of the timber lands that prudent considerations do not indicate as absolutely necessary. No timber should be allowed to burn up or to be left where it can never be reached because the state is bound by a law prohibiting its sale.

To get, therefore, a proper return upon the trust, there is only one method. That is to sell the state timber only as it becomes accessible in the course of ordinary logging operations and separate from the land. The sole objection claimed to this is that a full value for the timber is not always realized. This is an impeachment of the state land office officials, since no timber can be sold except at the value appraised by the state board of land commissioners. And, further, the constitution provides that no land can be sold at less than \$10 per acre. Give to this law a proper, businesslike administration and the state will sell each year less than 3 per cent of the timber holdings of the state and then only where sale is necessary to prevent loss, and to the operator who can well afford to give its full value.

KEEP THE LANDS AND GET ALL THE
VALUE FOR THE SCHOOLS.

No matter what disposition is made of the state's timber, it is against the dictates of prudence to sell the title to

any state lands not valuable for agricultural purposes.

When the timber is removed from these lands they are considered of no value. The owner, rather than pay taxes, allows them to revert to the county. They contribute nothing to the revenues.

These lands have a value. You who have seen the cut-over lands of Maine, New York, Michigan, Wisconsin, allowed to revert to the state for taxes, and then have seen the refuse timber or other materials of value on these lands so increase in value that the second cutting has realized more than the first, can readily see that in course of time our schools will surely reap from these lands returns often exceeding those from the cut of the virgin timber. Should this value inure to those who juggle with the county delinquent lands or to the state school funds, of which the state was created trustee? What would you, as a business man, do?

Nature is kind to us here in Washington. No sooner is land cleared than a new growth of timber starts up. It may be fir, hemlock, spruce or cedar. It is all valuable. In ten years Washington's stumpage has increased in value from 50 cents to \$1 per 1,000. Michigan stumpage is now worth from \$5 to \$9 per 1,000 feet. The cut of the middle west has been declining for five years. The timber of the south will only maintain the present rate of cut for about ten years. Wait ten years, and the State of Washington will come into its inheritance. Knowing these facts, would not a trustee be criminally negligent who did not realize the greatest value from its trust? Would any sane business man sit idly by and see such a property dissipated or burned up by fire?

THE STATE MUST PROTECT ITS TIMBER
FROM FIRE.

With property valued at from \$10,000,000 to \$15,000,000 at stake, the agents of the people have not appropriated one dollar for its protection. Each succeeding summer our skies

have been clouded and our magnificent mountains obscured by a mantle of smoke. Thousands and thousands of dollars of school property have been destroyed, not to mention the millions of dollars of private property, by that demon—the forest fire; and the only effort made has been the passage, in 1903, of a fire protection act that constitutes the county officials fire wardens, without funds, without adequate compensation, without power to enforce the provisions of the law. How long would a great business organization of over twenty departments exist that had no guiding and responsible head?

What was made every one's business became no one's business. If county commissioners wished, they did nothing; after the first year few of them moved a hand. Some county attorneys refused to prosecute open violators of the law.

In the State of Oregon, where the legislators of that state sold their school land trust for the traditional "mess of pottage," or at a price of \$1.25 to \$2.50 per acre, the governor of that state, in his annual message, having in the previous session vetoed a forest fire bill, stated that, since the state owned practically no lands, he would not vote one cent to protect the timber lands of private owners. Is that the attitude of a sane man? Is that the attitude in cities? Do they not employ firemen and all conceivable precautions and appliances to prevent the destruction of private property?

In the State of Washington the best estimates show that there is still standing about 175,000,000,000 feet of timber. If this timber was logged to-day the stumpage would be worth about \$1 per 1,000, or \$175,000,000. This is the return the private land owner would receive if it was placed on the market to-day; but see what the people would get from this:

Labor for logging, average \$4 per 1,000	\$700,000,000
Labor for sawing into lumber, average \$3 per 1,000	525,000,000
For transportation to markets of world, \$7.50 per 1,000	1,212,500,000
Total	\$2,437,500,000

Where, then, is the interest in this timber? Only 7 per cent in the land owner, 93 per cent in the people for its logging, manufacture and conveyance to market.

The following is a comparative statement of the importance of the chief industries of the state as shown by the annual production of each (the figures are from the United States Census Report):

COMPARISON OF WASHINGTON INDUSTRIES, CENSUS OF 1900.

Total value of food and kindred products	\$19,904,566
Total value of all farm products	29,618,455
Value of all iron and steel manufactures	2,592,946
Value of all metal and metallic products, other than iron and steel	4,867,672
Value of Washington fisheries for 1890	934,940
Total value of lumber and lumber products	32,400,258

In the session of 1903 the legislature devoted to the protection and advancement of these different industries the following amounts:

FISHERIES.

Fish Commissioner's office	\$24,000
Fish Hatchery Fund	122,865
	\$146,865

AGRICULTURE.

Grain Inspectors	\$5,600
Horticulture Commission	10,000
State Dairy and Food Commission	6,600
State Agricultural College	158,000
Grain Inspection Fund	35,000
	\$217,200

MINING.

Coal Mine Inspector	\$4,250
Commissioner	1,800
	\$6,050

These appropriations were necessary and were to the interests of the whole people. The state owns vast bodies of farm lands, but it does not own title to the fish or to any minerals, as such lands are reserved by the United States; but it owns \$10,000,000 to \$15,000,000 worth of timber, which in ten years will be worth double these figures. Yet it did not appropriate one dollar to protect it from fire when it is a well-known fact that each year large tracts of state timber are destroyed. Scattered as they are in every township, there is no forest fire of any consequence that does not reach state timber, and in several localities where selections have been made, great bodies

have been destroyed. In Cowlitz and Clarke counties, in one fire 200,000,000 feet of state timber were destroyed. Here the state lost \$200,000, and this is only a single instance.

This legislature has in its power to create here in this great commonwealth a school fund of magnificent proportions that will very materially aid in the establishment and maintenance of our educational institutions, that will become a pride to the state, a boon to every school child in all the years to come. No burden is so heavy, yet so willingly borne, as that of proper school facilities. Here you have the power to aid the taxpayer by managing these lands as would any trustee to the end that the greatest returns for the greatest time might flow into the school funds. To do this:

First. Reserve title to all school lands not suitable for agriculture.

Second. Sell only such timber separate from the land at its full market value, as it is necessary to prevent it

from destruction, and as is necessary in the course of ordinary logging operations.

Third. Enact a law that will guard the virgin timber of the uncut lands and the young growth of the cut-over lands from fire so that they may not become a blackened, desolate waste of no value, but, instead, lands that will each year grow into greater value to the increase of the school fund trust.

The opportunity and responsibility for giving the state lands proper protection lies with the present legislature. Up to this time not a single word has been said on the subject in either house or senate. Those people whose timber is burning up every year through official inaction, those who wish to see Washington the very foremost state in educational equipment; every parent, every school child, should see that this subject is taken up this session and the legislature made to protect the school trust imposed upon it.

THE GILA RIVER FOREST RESERVE

THE Gila River Forest Reserve, which was established by proclamation of President McKinley on March 2, 1899, was examined in the summer of 1903 by Mr. Theodore F. Rixon, of the United States Geological Survey. Besides examining the lands Mr. Rixon made a rough survey of the area and prepared a reconnaissance map.

The reserve includes several prominent mountain ranges, the principal of which are the San Francisco, the Tularosa, the Mogollon, and the Black. The southwest corner of the reserve is, generally speaking, a rolling country with many prominent buttes, and is without trees except a light growth of scrub timber in patches. The extreme southwestern portion, in which Mount McMullen raises its barren summit, is very rocky and abrupt.

Here the country drops perpendicularly several hundred feet into a desert tributary to San Francisco River, which lies distant 20 miles or more to the west. The reserve as a whole is well watered, all the streams from the mountain ranges carrying a considerable flow for a long distance beyond the forest regions. It is traversed by fairly good roads and trails, which follow the valleys.

Agriculture is carried on extensively along San Francisco River and there are a few farming settlements along Gila River, but no large agricultural area exists anywhere within the confines of the reserve. By introducing reservoirs and irrigating ditches the amount of available agricultural land could be largely increased. The market for the products of this district is so distant, however, being in

no instance less than 90 miles away, that a system of irrigation would hardly pay for itself.

Grazing, the most important of the industries of this region, requires careful attention and supervision to prevent the total destruction of the grass roots by overstocking. The mining industries in the reserve are confined to the Mogollon Mountains and practically to the Cooney mining district, although a few prospects are found on South Fork of Whitewater Creek. The advent of railroad facilities would undoubtedly bring the district to the front, but there is little prospect of that in the near future, as the territory is practically unproductive agriculturally and the only freight available would be the ore from Cooney district.

Logging operations have been carried on in a desultory manner for some years in different parts of the reserve. Wherever the yellow pine has been logged clean, the young growth on the lower lands is inevitably yellow pine, which is growing very rapidly in places. The young growth throughout the alpine and mountainous regions is white fir, red fir, limber pine, spruce, and balsam, and the proportion of reproduction is in the order named. At the lower altitudes the second-growth timber is

very limited. However close their proximity to streams, the different species of cottonwood, walnut, ash, alder, box elder, and sycamore reproduce themselves to a limited extent only, mostly in shady places along deep, rugged canyons. All of these varieties are indigenous to the soil, and grow freely wherever there is sufficient moisture. The depth of humus is slight, the lowlands being entirely devoid of it. The litter and the underbrush among the alpine timber are very heavy. This reserve has suffered very little from fires.

If the totally barren area is not taken into consideration, the Gila River Forest Reserve is a well-timbered region. The total area examined is about 3,640 square miles. Of this, 2,593 square miles, or $71\frac{1}{4}$ per cent., are covered with merchantable timber of extra quality; 2 square miles have been burned; 90 square miles, or $2\frac{1}{2}$ per cent., have been logged; and 955 square miles, or $26\frac{1}{4}$ per cent., are naturally timberless. The timber of the reserve amounts to a total of 5,867,169,750 feet B. M., giving an average stand of 3,532 feet B. M. per acre over the entire timbered belt. Yellow pine constitutes 57.75 per cent. and red fir 28.37 per cent. of the merchantable species in the reserve.

RAILROAD TIES OF LOBLOLLY PINE

The Bureau of Forestry Finds Out How to Economize in Their Production

A GOOD example of what is being done along the most practical lines by the Bureau of Forestry is furnished by the results of a study of loblolly pine in east Texas which it has recently made. Vast quantities of loblolly pine exist in the Southern States, some of which is sold on the market as shortleaf yellow pine. The wood of loblolly pine is inferior to that

of longleaf and of shortleaf pine, partly because of the rapidity with which it decays when exposed to the weather or in contact with the soil, but for many purposes it answers just as well as the more valuable species. It is certain to increase greatly in commercial value and its use is now extending rapidly. As the longleaf and shortleaf pines become scarcer and higher in

price loblolly is sure to replace them to a great extent; this study of its uses is therefore very timely.

One of the chief purposes for which loblolly is now used in the Gulf States is for railroad ties. The wood is not durable and the tie in its natural state is short-lived, but by preservative treatment it can be made to resist decay for a number of years. The discovery that treated loblolly pine is an excellent substitute for longleaf for railroad ties is greatly to the benefit of the railroads since it enables them to use a less expensive tie. It also benefits the country at large by cutting off one of the heavy demands made upon the longleaf forests and thereby setting free a corresponding amount of that material for the general market.

In making loblolly pine ties there are many wastes and the drain upon the existing forests is greater than it need be. The recent study was therefore made for the purpose of showing the rate of growth of the trees, and how ties could be produced more economically.

Loblolly pine is found in commercial quantities in ten counties of east Texas, where it covers an area of nearly 2,880,000 acres, and is hewn into cross-ties on a larger scale than in any other State. The magnitude of this industry results from an abundant supply of loblolly pine of sizes suited for pole ties. It is estimated that from 75 to 80 per cent. of the present loblolly stand in Texas is timber of tie size, the remainder being large enough for lumber. The preponderance of comparatively young and small timber is due principally to severe storms in 1865 and 1873 which overthrew the old pine on many thousands of acres and established new stands of young trees.

Loblolly is adapted to a wider range of soils than any other pine in east Texas. This, with its frequent and prolific seeding, its rapid rate of growth, and its immunity from hogs which eat the roots of the young long-

leaf pine, enable loblolly pine to reproduce readily on denuded land. In many situations it competes successfully with longleaf pine and comes up under hardwoods if the stand is not too dense, and rapidly outgrows them. The conditions in east Texas are most favorable to this species; it is sure to increase in commercial importance and may become the principal source of timber supply of the region.

Three counties in east Texas—Orange, Jasper, and Newton—furnish annually from 1,000,000 to 1,500,000 hewn loblolly pine ties. The trees cut for ties vary in size from 11 to 17 inches in diameter, measured breast-high. The hewers prefer diameters of 12, 13, and 14 inches as the smaller the tree, above tie specifications, the less the labor in squaring it. The largest number taken are 13 inches in diameter. This practice is very wasteful, for the average tree 11 inches in diameter is about 35 years old and is growing rapidly. The average yearly increase in value between 11 and 13 inches is over 7 per cent., and from 13 to 14 inches 5.5 per cent. After the latter size is reached growths falls off so fast that for the next inch of growth the increase averages only 2.5 per cent., and at 16 inches the value for hewn ties ceases to increase.

These facts point out the rule which the owner should follow in selling trees for ties. Those 11, 12, and 13 inches in diameter are growing so rapidly both in size and value that to cut them consumes the capital that is bringing him the best rate of interest. The tie maker should be confined to 14, 15, and 16-inch diameters. Trees above 16 inches should be preserved until they can be profitably felled for lumber.

The adoption of this rule will be best for the owner and for the productive future of the forest as well. It will however necessitate a complete change in the method of getting out ties as they will have to be sawed instead of hewed. But this too would be a gain for both owner and forest,

since hewing is a very wasteful method of tie production. Under it many of the larger trees are cut with unnecessarily high stumps in order to save labor in hewing down the butts. In many other cases the trees are not used as far up into the tops as they might be. Further, the hewing process itself is very wasteful and leaves in the woods a quantity of litter in the shape of slabs and chips in which fire is often started and the forest seriously damaged.

If hewing is continued it would be unwise to restrict the cutting to 14, 15, and 16-inch trees for that would involve increased waste, but the value of the smaller sizes demands this restriction, and sawing should take the place of hewing. When the larger logs are sawed several boards can be obtained from the wood now wasted in slabs and chips as the hewing progresses.

There is still another form of waste resulting from hewing. In grading ties the railroads are very strict about accepting none under specification sizes, but they do not object to some excess in size. This, and the fact that less labor is required to produce large ties, has induced hewers to make many ties larger than they need be. This

is a small matter in the case of each tie, but as they are cut by the million the excess represents in the total a very large waste of wood. It means also an unnecessarily great consumption of creosote or other material used in the preservative treatment, since the total bulk of wood which must be treated is greater.

It is estimated that from 48 to 70 per cent. of the timber cut for pole ties goes into chips, slabs, and excess over the maximum dimensions required. Adding all causes of waste it is found that the percentage of timber actually used in hewn ties is no more than 25 to 30 per cent. of the total volume of the trees felled.

Loblolly pine grows so rapidly that two crops of pole ties can be produced in less time than is required to grow one crop of longleaf pine ties, and from each of the two crops there will be a larger average yield of ties. This tremendous advantage of loblolly pine is increased by the marked ability of the tree to reproduce itself. Conditions in east Texas are almost ideal for the maintenance of forests of this tree, and the opportunity to earn good returns by their conservative management is equalled in few parts of the country.

LIGNITE OF NORTH DAKOTA AS APPLIED TO IRRIGATION

UNDER the direction of Mr. N. H. Darton, of the United States Geological Survey, who is making a general investigation of the underground-water resources of western United States, Mr. F. A. Wilder has recently examined the lignite deposits of North Dakota and studied their relation to irrigation.

The areas most favorably situated for irrigation in North Dakota are the broad terraces along the Missouri and its tributaries. These streams are deeply intrenched, and it does not

seem possible by means now available to raise water from them a vertical distance of 150 to 400 feet over the bluffs that rather sharply bound the broad valleys.

The fertile terraces in the valleys of the streams range from 15 to 100 feet in elevation above water level. As there is an abundance of lignite along these streams, it has seemed desirable to consider the possibility of irrigating the 250,000 acres included in the terraces by pumping water directly from the rivers, using lignite as a fuel. To

this end the lignite area has been studied and the lignite beds investigated. Practical tests have been made to ascertain, at least in a rough way, the cost of irrigating river flats which are less than 100 feet above the streams. The Missouri and its tributaries in North Dakota have been followed, and the extent and elevation of the river flats and the amount and quality of the lignite near them have been noted.

If only a small fraction of the western part of the State is under irrigation the productiveness of the whole region will be greatly increased. With a few acres which can be watered at will, and abundant range of cattle in the broken or rolling land back of the valley, ten families, by combining farming with cattle raising, will prosper where one finds a living now. These conditions will lay a sure foundation for the dairying industry, which should be one of the foremost of the State.

The only workable beds of lignite east of the center of the State are in the Turtle Mountains and at the southern bend of the Sheyenne River, about 25 miles southeast of Valley City. The region in which discoveries of lignite might reasonably be expected may be roughly bounded on the east by a line beginning at the northern boundary of the State, 30 miles east of the Minneapolis, St. Paul and Sault Ste. Marie Railway, and extending southeast to Harvey, thence south through Steele to the southern boundary. On the north, south, and west the lignite continues beyond the boundaries of the

State. This region is of very great extent, having an area equal to half that of the State of Ohio. The extent and thickness of these lignite beds are discussed in detail by Mr. Wilder. The lignite output of the State amounted in 1902 to 315,800 short tons, valued at \$428,270.

Judged by ordinary standards the lignite is very inferior. Its fuel value has been determined analytically, and the results of the chemical, calorimetric, and practical evaporative tests by which it has been examined are described by Mr. Wilder. The subject of pumping water by means of power plants supplied with lignite fuel is discussed by Mr. Charles S. Magowan.

Mr. Wilder says in conclusion that opportunities to reclaim arid lands appear to exist in the larger flats on Missouri River. In choosing a flat where reclamation by pumping may be tried under most favorable conditions, a number of factors must be kept in mind. Nearness to a railroad and a market are as essential as an abundance of cheap fuel and good land. An active interest on the part of the resident owners is necessary. Some of the lignites from partially developed but extensive deposits in North Dakota and Texas, when tested in the gas producer and gas engine, have shown unexpectedly high power-producing qualities, such as promise large future developments in those and other States. Some of the American coals, and the "slack" produced in mining these coals, can be briquetted on a commercial basis.



THE RECLAMATION SERVICE

News of the Government Irrigation Work--Progress of Old Projects and Plans for New Ones

Want Sun River Project Completed.

The Director of the Geological Survey has received a memorial bearing the signature of 226 citizens of Great Falls and Cascade County, Montana, calling attention to the importance of early action by the Department on the Sun River project. The memorial, in part, is as follows:

"Realizing full well the benefit that the State of Montana will derive from the execution of the provisions of the National Irrigation Act, and knowing as we do the great interest you have taken in carrying out the provisions of this law, we desire to say that the people of Great Falls and of Cascade County, Montana, heartily endorse your actions and work and write this letter to express to you our appreciation of the great work you are doing in Montana and especially in connection with the Sun River irrigation project.

"As you know, the land to be reclaimed by this project is a broad prairie extending from the Teton River on the north to the Sun River on the South, a distance of thirty miles, and from the Rocky Mountains on the West to the Missouri River on the East, a distance of seventy miles. This land, although extremely rich in all the elements of fertility, without water is only fit for grazing, but when irrigated its productiveness cannot be surpassed anywhere in the United States. The preliminary survey of this project has been made and we are reliably informed that the engineers of the Reclamation Service estimate that not less than three hundred thousand acres of cultivable land lying between the Teton and Sun Rivers (much the greater portion of which is still Government property, a fact that cannot be advanced in favor of any other project in this State) can be reclaimed

with the waters of the Sun River.

"Such being the case, from which it is apparent at a glance that at least twice as many people can be supplied with homes thereunder than is possible to be accommodated under any of said other projects, with a like expenditure of money, the only logical deduction that can be made therefrom is that the Sun River project, on good sound business principles, if on none other, should be the first constructed in Montana under the National Irrigation Act. And even now, there are thousands of people anxiously watching and waiting for the Government to reclaim the land above described in order that they may build for themselves homes upon what is now practically a desert waste, but which will, under the magic touch of irrigation, yield rich rewards to the industrious husbandman, and this Sun River project presents a splendid opportunity for the Government to show to the people what can be done by the Reclamation Service in the way of making homes for settlers.

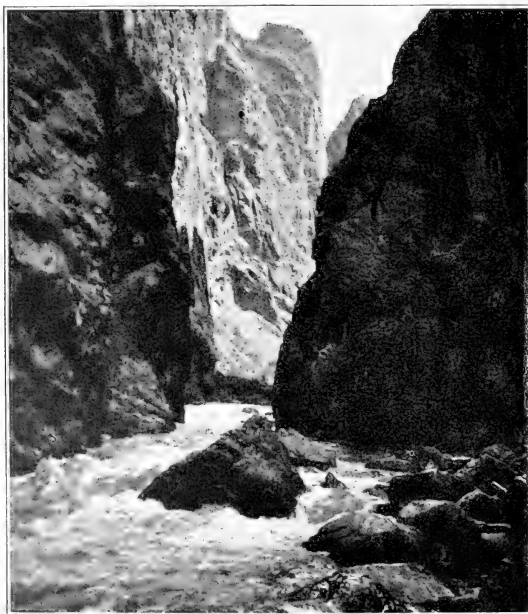
"The purpose of this letter is to express to you our great anxiety for a very early completion of this Sun River project and to say to you that we, as citizens, are ready and willing to assist you in your great efforts, and also the engineers, in any way possible, to further this project. We will at the proper time, if you so desire, take it upon ourselves to solicit and obtain contracts for water from the prospective settlers. The Great Falls Commercial Club, the members of which have hereunto subscribed their names, hereby agrees to assist in every way possible this great work, and we respectfully ask that you will use your influence to the end that the Sun River project shall be the first undertaken by the Government in this State."

Pumping for Irrigation.

The large percentage of irrigable land throughout the West lying at heights too great to be reached by gravity systems, presents a problem which can be solved only by the use of pumping plants, and the engineers of the Reclamation Service have been making investigations and working up estimates on several projects to determine the feasibility of their use in

descend suddenly to a lower level, making the additional cost for the power little more than the expense of erecting the necessary buildings, water wheels and generators. In many sections water power may be developed in the mountains or at falls, and transmitted electrically to lands some distance away where the water is to be pumped and used.

The high rates charged for power



Site of Proposed Dam, Gunnison Canyon, Colorado.

connection with the Government irrigation works. The most important and variable factor to be considered is the cost of power and of operating the plant.

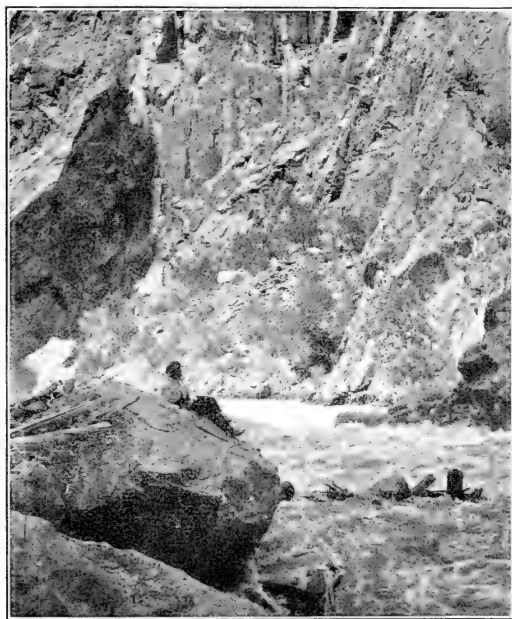
In many cases water power may be developed as an incident of the construction of dams for storage and diversion, or in canals where the nature of the country requires the water to

by commercial electrical companies have not been found prohibitive in many sections of the West where the value of the crops to be irrigated is relatively high, or where the water to be pumped is only to augment the main supply during dry periods. In the case of national irrigation works minimum costs may be expected from the fact that no interest is charged by

the Government on the money advanced for installing the plant, and the item of profits involved in commercial enterprises will also be eliminated.

In many sections of the West, however, water power possibilities are not present, and it becomes necessary to locate a cheap fuel supply for the production of steam power. Coal and oil are found in many parts of the arid region, and often may be delivered at

varieties of coals from all parts of the United States. The results of various commercial tests indicate that under similar conditions one pound of the bituminous coal of Pennsylvania or West Virginia will evaporate about 10 pounds of water into steam; one pound of Illinois or Missouri coal will evaporate about 7 pounds of water into steam; and one pound of western lignite, about five pounds.



Typical View of Gunnison Canyon, Colorado.

the pumping plants at very low cost. Western coals are, as a rule, poorer steam producers than coals from the Eastern or Middle States. Tests to determine the relative evaporative powers are now being made by the United States Geological Survey at St. Louis, and the data obtained will be reliable and important for comparing the steam producing qualities of va-

Many grades of coal besides lignite are, however, found in different sections of the West, Colorado alone producing coals ranging all the way from lignite to anthracite. On account of the extreme variations in the kinds of western coals it is just as important to know the steam producing power of the coal to be used as its cost per ton, in order to estimate closely the

probable cost of the fuel for a given pumping plant.

Crude oil burned under steam boilers is an ideal fuel when its cost is not too high, and the small gas engine in its many forms and types is one of the best means of obtaining power for irrigation in units up to as high as 30-horse power. The possibilities of utilizing in an economical way any kind of fuel available for pump engines are deemed worthy of consideration by the engineers of the Reclamation Service.

Estimates of probable costs of power and pumping plants necessitate a knowledge of all the factors peculiar to each project; for instance, the duty of water, materials for construction which can be secured locally, the character of the water to be pumped and of the ground on which the plant is to be built, the type of plant peculiarly suited to the various conditions, etc. On projects where oil, coal or other fuel furnishes the power for pumping, it has been suggested that each water user be required to pay for the amount of water actually delivered to him, since the operating expenses will depend so largely upon the quantity of water pumped. This would tend to foster economy in the use of water and the annual expenses of the water-user could be adjusted from year to year to correspond with the varying quantities used, depending upon whether the season is wet or dry. A minimum annual payment per share would cover the fixed charges for keeping up the plant.

Want Nevada Underground Waters Investigated.

Governor Sparks, of Nevada, has transmitted an assembly memorial and joint resolution through the Secretary of the Interior to the Director of the Geological Survey, relative to Federal aid in the development of artesian and subterranean sources of water supply in Nevada.

The memorial recites that there are several million acres of land within the State of Nevada, at present lying

idle, uninhabited, and of no assessable value, the general government estimating this area at 20,000,000 acres of agricultural lands and 30,000,000 acres of grazing lands, with only a small portion of the same under cultivation or occupied for grazing purposes, owing to the absence of water. A supply of water for irrigating purposes would render these lands very attractive, and situated as they are in a favorable climate, with soil susceptible of the highest cultivation, would greatly increase the population of the State and become a source of revenue to the Government.

The memorialists believe that an abundance of water can be obtained to reclaim large tracts of the arid lands within the confines of the State, but owing to the fact that the title of these lands rests in the general Government, private capital cannot be secured to undertake the work. It is therefore asked that the sum of \$500,000 be expended under such rules and regulations as the Secretary of the Interior may adopt in order to inaugurate measures for the development of a system of artesian and subterranean water supplies within the State.

The department recognizes that to no State in the great arid West is the subject of water supply and its conservation of greater import than to Nevada. With the gradual narrowing of the unoccupied lands of the public domain, the reclamation of even a small percentage of the millions of acres of land of inexhaustible fertility located in this State, becomes a question of paramount importance to the nation.

It is further recognized that with a guaranteed and sufficient supply of water no other State, with the exception of California, could equal Nevada in the variety of agricultural products or the certainty of generous harvests.

The water system of a State is an object of interesting study, and it is promised that Nevada will be the field for a very thorough and comprehensive investigation on the part of the experts of the Geological Survey. The

State Legislature, by wise laws, has put itself in close coöperation with the Reclamation Service, thereby assuring the fullest exploitation of its resources by that bureau.

In the matter of an investigation of underground sources of supply, the Director of the Survey will initiate an investigation early this spring which will be continued until complete data on this subject have been obtained. At the present time the department has very little knowledge of any areas in the State where there is sufficient underground water to be pumped to the surface to reclaim public lands. Assurance is given, however, that during the coming season a thorough investigation will be made with a view to ascertaining whether there are such waters, and the conditions under which they can be obtained.

Underground Tests on Los Angeles River.

A paper that will contribute materially to our knowledge of the important subject of underground waters and their use in arid regions has recently been published by the United States Geological Survey. It is a record by Mr. Homer Hamlin of underground tests made in the drainage basin of Los Angeles River and illustrates the conditions under which ground water usually occurs in arid regions and the fluctuations in the water level due to rainfall and other causes. The method used in testing is of special interest. It is a method invented by Prof. Charles S. Slichter, of the Reclamation Service, U. S. Geological Survey, and fully described in an earlier Survey publication entitled "The Motions of Underground Waters." As the method has, up to the present time, been used by few investigators, the details of these tests are particularly important.

It was in September, 1902, that Mr. Hamlin was placed in charge of experiments to determine, if possible, the amount of underflow passing through the narrows of Los Angeles River at Huron street, Los Angeles, California.

Velocity measurements were begun under direction of Professor Slichter with the apparatus invented by him. As the work progressed and tests were made at greater depths it was found necessary to modify this apparatus to suit local conditions. The various devices used in the tests, the arrangement of the instruments, the methods of testing found most satisfactory, the results obtained at each of the testing stations, and the amount of underflow supposed to pass the Huron street section are fully described by Mr. Hamlin in his report.

Mr. Hamlin concludes his report with a summary of suggestions based on experience gained during the work at Huron street and in the San Fernando Valley. They are as follows:

(1) The location of the section where it is proposed to test the underflow should be carefully studied. It should be, if possible, in a straight stretch of the valley, and at some distance, either up or down, from large tributary streams.

(2) The form and slope of the water table should be ascertained and the line of test stations should be placed most advantageously.

(3) In order to secure accurate results, the testing stations should be close together along the line of the section.

(4) The well screens should be short, and the ground should be tested at intervals of 2 to 4 feet in depth, down to bed rock when possible.

(5) If possible, the porosity of the pervious beds should be determined.

(6) In making deep tests some form of drive pipe and screen, such as is described in this report, should be used.

(7) Recording ampere meter and switch clocks should be used. The discharge from a given section will undoubtedly be far less than is expected, the popular tendency being to greatly overestimate the amount of underflow. Even if the results obtained by this method of testing are not so accurate as desired, they are,

nevertheless, of great value, as they enable investigators to compute, approximately, what could only be roughly estimated before.

The Underground Waters of Washington.

A brief but very satisfactory account of the water resources of the State of Washington as represented by municipal supplies, deep wells, and springs has been prepared by Mr. Henry Landes, of the United States Geological Survey, under the direction of Mr. N. H. Darton, geologist in charge of the western section of hydrology.

The counties of the State are taken up in alphabetic order and a general statement is made concerning the location, rainfall, and most striking topographic and geologic features of each county. This is followed by data concerning the municipal systems, deep wells, and springs in the county. Information regarding the municipal water supplies is complete to the present time, as blanks were sent to clerks or other officials of cities and towns and practically all were filled out and returned. The blanks for the deep wells were not returned as generally as was desired, but almost every section of the State where such wells occur is represented, and those described may be taken as types of their kind in each county. Springs occur so very generally throughout the State that probably only a small fraction of them is represented in the blanks filled out and returned.

The value of the report is greatly enhanced by a map of Washington, on which is shown the mean total precipitation, and 16 pages of tables of deep wells, municipal water supplies, and representative springs. This paper, which is entitled "Preliminary Report on the Underground Waters of Washington," is listed as Water-Supply and Irrigation Paper No. 111.

To Protect Government Employees.

The registrars and receivers of the U. S. Land Offices in Arizona, Cali-

fornia, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming were recently instructed by the Commissioner of the General Land Office to notify all persons who have heretofore entered, or who may hereafter enter, any of the lands which have been segregated under the provisions of the Reclamation Act of June 17, 1902, that the leasing of such lands or portions thereof to other persons who have been and are conducting the business of selling alcoholic liquors on said lands, principally to the employees engaged on the Government works, that such leasing either by themselves or others will be deemed sufficient cause for the cancellation of the entries embracing the lands so used or occupied.

The officers of the land offices are further directed to give the widest possible publicity to the fact that such use of any lands withdrawn under this act, whether such lands have been entered or are unoccupied, will be prevented by proper actions in ejectment, by injunction, or otherwise.

These instructions have been called forth by the deplorable conditions existing in Nevada, where the Government work employs several thousand men. Homesteaders have leased a portion of their lands to persons engaged in the liquor business, and murder and robbery have been rampant in consequence. The Commissioner's decision is likely to correct these conditions, and will undoubtedly prevent their occurrence in other sections wherein the Government is about to engage upon similar works.

Private Lands Under Government Reclamation Projects.

The Reclamation Act was intended, primarily, to provide for the irrigation of lands belonging to the United States. It was plain, however, to Congress that scarcely any project would be found in which there was not a considerable amount of private land.

The experience of the Reclamation Service has shown that in the most inaccessible localities in the West, more or less private land is encountered in the development of the projects. The majority of the projects which have been under consideration, and among them some which are practically new discoveries, involve in the area to be irrigated a considerable amount of private land.

The proper manner of dealing with these private lands has been a difficult question to solve, having in view the interests of the United States on the one hand and of the private land-owners on the other.

gress has provided that no right to the use of water shall be sold for more than 160 acres of land in private ownership to any one person, and, further, that the land-owner must be a resident on the land or in the neighborhood, and that no such water right shall permanently attach until all payments therefor have been made.

This involves a limitation upon the use of private lands while the right to the use of water is being paid for. In view, however, of the fact that the water right furnished by the Government enhances the value of the land in a proportion far greater than the actual payments required by the Govern-



Ball's Head Reservoir, Colorado River, California and Arizona.

The means adopted for the organization of water users associations involve a specific recognition of prior vested water rights, and those who are in position to claim such rights are left undisturbed as to such claims, the requirements of the Government simply calling for their proper share of the cost of construction of the necessary irrigation works.

In order to protect these projects of the Government from a monopoly of land-owners or water-users, Con-

ment, the private land owner cannot properly complain of these restrictions which will be placed upon him during the period of ten years while he is paying for the water right.

When the Government says: "I will charge you \$20 an acre in ten annual installments of \$2 each, without interest or profit, to furnish water to your land, which is now worth less than \$10 an acre, on condition that you will live on it or in the neighborhood during ten years," the land-owner cannot

complain if he accepts the offer knowing that, as a result, his land will have a ready sale at \$100 per acre or more.

Rapid Work on Minidoka Project.

Work on the Minidoka project, Idaho, is being pushed vigorously and rapid progress is being made. The Secretary of the Interior advertised for bids for the construction of about 21 miles of main canals and 102 miles of branches and laterals on April 12th. This work will involve the excavation of about 3,500,000 cubic yards of

The Mindoka dam, spillway, and forebay canal now being rapidly pushed to completion, involve the excavation of 205,300 cubic yards of material. The dam is of the rock fill type, and will be 650 feet long on top, 50 feet high, and requires the placing of 110,000 cubic yards of rock, 101,000 cubic yards of earth, 1,200 square yards of rip rap, and 1,000 cubic yards concrete core wall. In the spillways there will be 3,000 cubic yards of concrete, 8,000 cubic yards of rock embankments, 6,500 cubic yards concrete



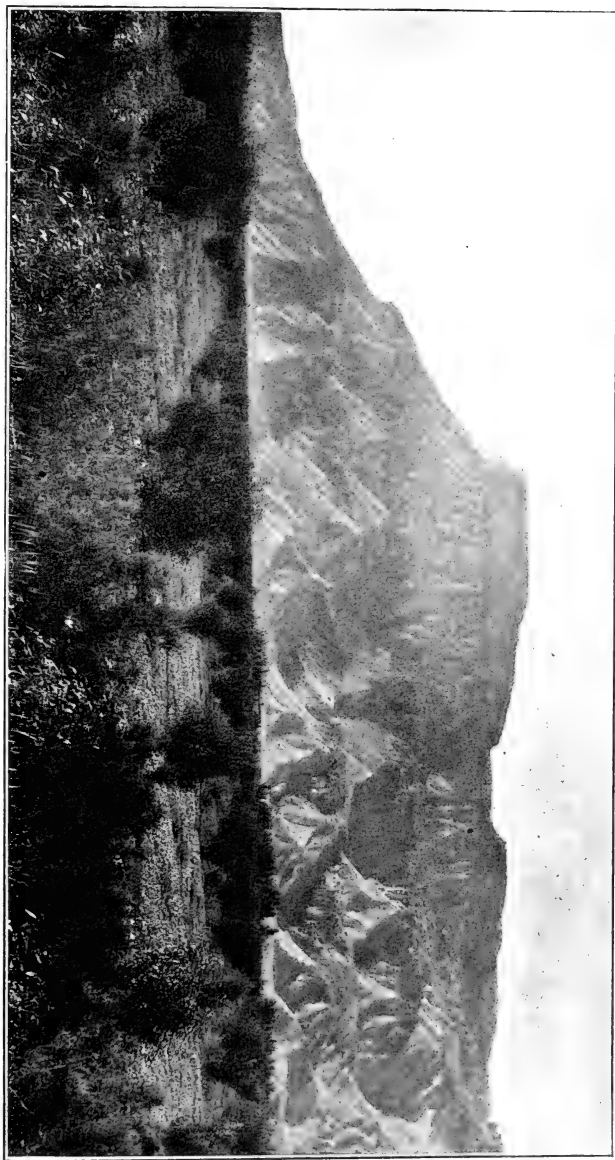
Canyon Above Reservoir Site, Salt River, Arizona, Looking Downstream.

earth, 45,000 cubic yards of loose rock, and 170,000 cubic yards of solid rock, and the erection of structures involving 2,000 cubic yards of masonry, 58,000 pounds of steel, 68,000 pounds of cast iron, and 140,000 feet B. M., of lumber.

Specifications, forms of proposal and plans are now on inspection at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., and at the office of District Engineer D. W. Ross, Boise, Idaho.

in canal, 3,000 pounds of steel in the same, and 57,500 pounds of steel gates and guides for power and irrigation canals.

At the dam site the river flows through a low ridge of lava rock, the channel being in a solid formation of lava and only 570 feet in width. At low stage the river is from one to two feet in depth over about 400 feet of its bed, most of the water flowing at that time in a channel about 75 feet wide on top and 30 feet deep at the deepest



Garfield Point, Colorado, (Little Book Cliffs) and Orchards in Foreground.

place. The maximum flood discharge is about 50,000 second feet. The construction plant now on the ground consists of an air compressor for driving rock drills, cableways for transporting and placing the material in the dam, a dredge for excavating the gravel and earth to be used for back-filling, a railroad half a mile long for hauling this material to the dam, and a high trestle built across the river from which the major portion of the back-filling will be done. There are two cableways placed parallel to each other and having spans of 1,100 feet. They are suspended from towers, the tops of which are about 1,000 feet above the river. These cables are arranged so that the rock which will be excavated from the upper section of the canal can be transported readily and dumped into the dam. The steel-skips or boxes in which the material is loaded when convenient on the cableways, have a capacity each of more than 3 cubic yards, or a weight when loaded with rocks of about 5 tons. These skips are dumped by the tower man, who drops the material into the water from a height of from 40 to 60 feet, thus forming very compact embankments which, when the back filling is

added, will be practically water tight.

The construction plant is now in full operation, and the embankments constituting the first section of the cofferdam will soon be ready for the construction of the core walls. The contract provides for the completion of the dam and spillways by November 17, 1905, and the construction of the dam will provide splendid facilities for the development of power. The minimum discharge of the river at this point which will be available for this purpose, is 2,100 second feet. This can easily be increased to 3,000 second feet by storage on the headwaters of the stream. This water can be passed through walls under a head of about 50 feet, which will provide for the development of more than 17,000 horse power. It is proposed to use the major portion of this power for pumping water to lands situated above the gravity system of canals which will be constructed during the coming season. From 50,000 to 75,000 acres can be reclaimed at a reasonable cost by pumping.

Bids are also asked for the construction and completion of a pole line and telephone system about 18 miles in length in connection with this project.

RECENT PUBLICATIONS

The Prickly Pear and Other Cacti as Food For Stock. Bulletin No. 74, Bureau of Plant Industry, U. S. Department of Agriculture. By DAVID GRIFFITHS. Pp. 46, with five half-tone plates and several line drawings. Washington, Government Printing Office, 1905.

An investigation of the forage value of different species of cactus was undertaken by the Bureau of Animal Industry, in response to numerous letters requesting such information. The investigation revealed the fact that certain cacti have long been in use as forage, and the Bulletin noted here contains descriptions of the varieties most suited, and methods of preparing the same. A large part of the investigation is still under way in regard to the chemical composition of the most useful forms, methods of planting, yield, varieties, methods of preparation, and feeding, etc., but this preliminary Bulletin contains some very valuable information

for the stockman. In view of the recent "spineless cactus" achieved by Luther Burbank, it is interesting to note that the Agrostologist says that "if it were not for the spines on this class of plants they would probably have been exterminated long ago, and there is some doubt whether there would be any use for spineless forms."

The Luquillo Forest Reserve, Porto Rico. Bulletin No. 54, Bureau of Forestry, U. S. Department of Agriculture. By DR. JOHN GIFFORD. Pp. 52, illustrated. Washington, Government Printing Office, 1905.

The Bulletin noted here embodies the investigations made by Dr. Gifford recently on a special trip undertaken for the purpose of determining the general conditions, forest wealth, accessibility, and industrial conditions of the Luquillo Forest Reserve, which was set aside by proclamation of President Roosevelt on January 17, 1903.

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The reports, bulletins and other applications of the Philippine Forestry Bureau should be read by all desiring to enter the service. Copies may be obtained by addressing the Forestry Bureau, Manila, P. I.

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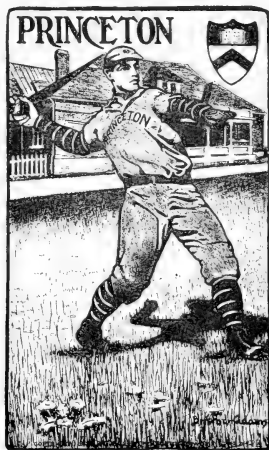
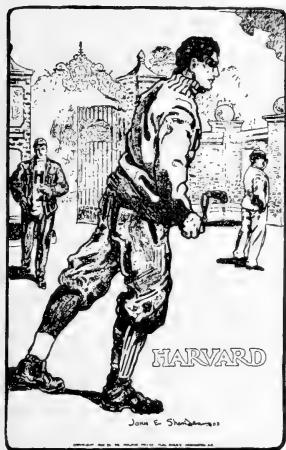
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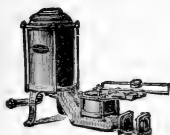
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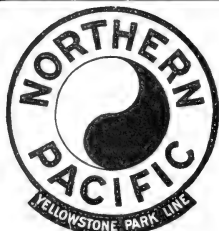
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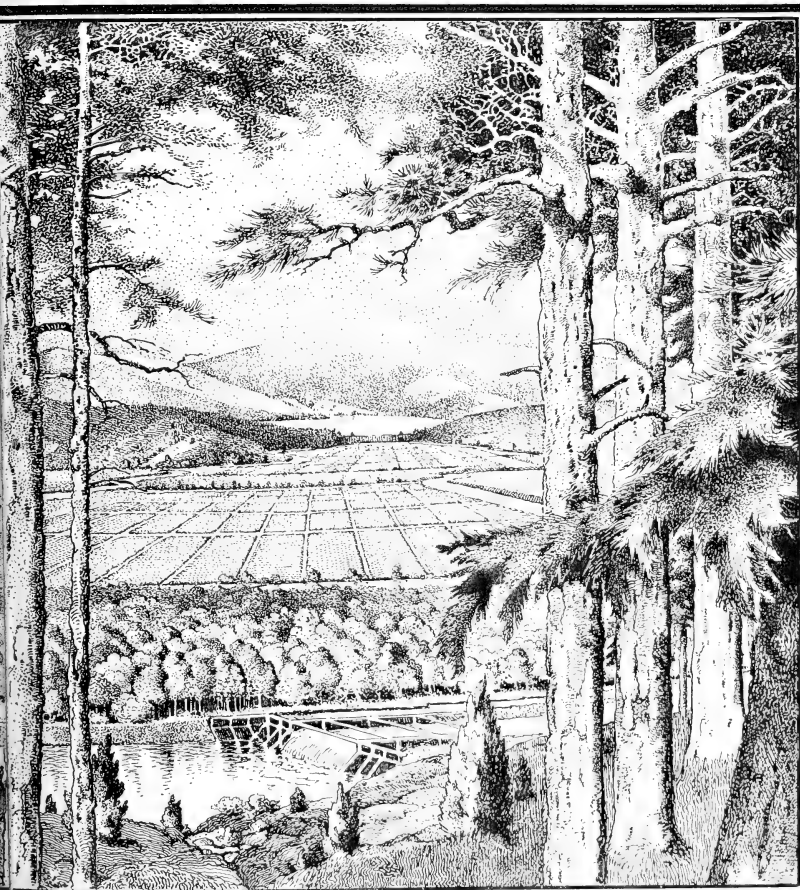
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The objects of this Association are to promote :

1. A business-like and conservative use and treatment of the forest resources of this country ;
2. The advancement of legislation tending to this end, both in the States and the Congress of the United States, the inauguration of forest administration by the Federal Government and by the States ; and the extension of sound forestry by all proper methods ;
3. The diffusion of knowledge regarding the conservation, management, and renewal of forests, the proper utilization of their products, methods of reforestation of waste lands, and the planting of trees.

The Association desires and needs as members all who are interested in promoting the objects for which it is organized—all who realize the importance of using the natural resources of the country in such a manner as not to exhaust them, or to work ruin to other interests. In particular it appeals to owners of wood-lands, to lumbermen and foresters, as well as to engineers, professional, and business men who have to do with wood and its manifold uses, and to persons concerned in the conservation of water supplies for irrigation or other purposes.

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Forestry and Irrigation

H. M. SUTER, Editor

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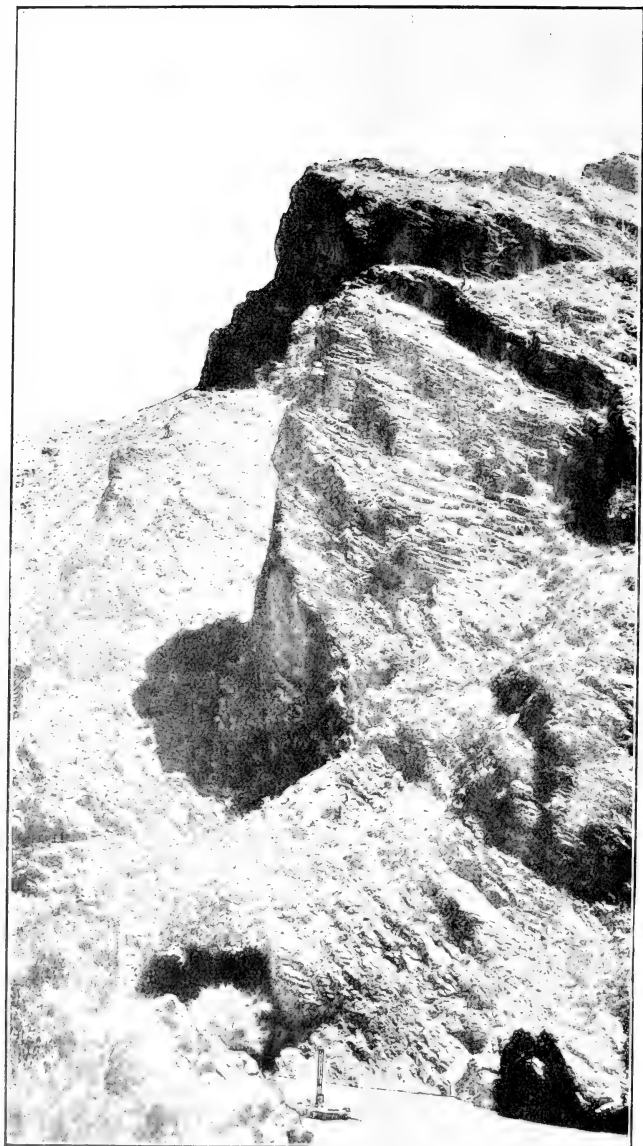
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JOHN F. SHEKIDAN



San Carlos Dam Site, Arizona; View of Left Bank and Cliff Above.

Forestry and Irrigation.

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MAY, 1905.

No. 5

NEWS AND NOTES

To Visit Reclamation Works.

A Congressional excursion composed of members of both irrigation committees of both the Senate and House of Representatives, and others, will leave Kansas City on June 1, and will make a personal inspection of a number of the large irrigation projects which the Government is constructing in several of the Western States and Territories.

The first stop will be made at El Paso, where a visit will be paid to the Engle dam site on the Rio Grande. The party will also take a sixty-mile drive into the mountains of Arizona to examine the construction work now well under way on the Roosevelt dam. A careful study will be made of conditions on the Colorado River, the visit extending into the famous Imperial Valley, portions of which are several hundred feet below sea level. In California stops will be made at Riverside, Los Angeles, San Francisco, Redding and Sacramento.

On the 17th of June, the third anniversary of the Reclamation Act, the Congressional party will be at Hazen, Nev., at which time water will be turned upon 50,000 acres of land under the Truckee-Carson project, constructed by the Government, and the first of the large irrigation projects to be put into operation. Leaving Nevada, short stops will be made in Ogden, Salt Lake, at various points in Idaho, Oregon, Montana, Wyoming and Colorado. The party will break up July 4th at Denver, Colorado.

Included in the party are the following: Senator and Mrs. Newlands, Senator and Mrs. Foraker, Senator and Mrs. Fulton, Representatives Mondell,

Cooper, Reeder, Marshall, Smith, Jones, Hitchcock, and their wives; Senator and Mrs. Simmons, Senator and Mrs. Dubois, Senator and Mrs. Warren, Judge J. I. Parker, representing the Secretary of the Interior; C. J. Blanchard, representing the Reclamation Service; W. H. Hunter, *Washington Post*, and Mr. Arthur Ruhl, *Collier's Weekly*.

The full itinerary of this trip is as follows: The party will assemble at and leave Kansas City June 1; June 3 to 5, El Paso, Texas; June 5, Maricopa, Ariz.; June 6 to 8, Phoenix, Mesa and Maricopa; June 9 and 10, Yuma, Old Beach and Calexico; June 11, Redlands and Riverside, Cal.; June 11 to 13, Los Angeles; June 14 and 15, San Francisco; June 15, Redding; June 16, Sacramento; June 17-18, Sparks and Hazen, Nev.; June 19-20, Ogden and Salt Lake; June 21-22, Minidoka, Nampa, and Boise, Idaho; June 23 and 24, Portland; June 25, Seattle; June 27, Billings and Toluca; June 28, Cody; June 29, Toluca; June 30, Alliance, Guernsey, Wheatland, and Cheyenne; July 1, Cheyenne and Denver; July 2, Montrose; July 4, Denver.

In passing it should be stated that the special train for this excursion is furnished by the railroads and other expenses are met by members of the party. Thus the sensational press will have little opportunity to screech about an expensive "junket" on the people's money.

Grazing on the Forest Reserves.

The season for grazing is now nearly over, but from the time the management of the forest reserves was transferred to the Bureau of Forestry

to the present time there have been issued 825 permits for the grazing of sheep, and 4,750 permits for the grazing of cattle and horses on the public forest lands. These permits embrace a total of approximately 1,320,000 sheep and 762,380 cattle and horses which have been grazed on the forest reserves in the past season. The Forest Service still have to issue permits for about 52,500 head of cattle and horses, and 112,000 sheep.

The figures given here apply only to the reserves established for a considerable length of time. In the new reserves that have, or will be created, it will be the policy of the Forest Service, where the livestock industry is of special importance, to allow all of the stock customarily using the range the privilege of grazing for this year, and permits will be issued to graze the stock which are now occupying the ranges, including cattle, horses, and sheep. In the following season if the ranges are found to be over stocked, the number will be gradually reduced until the proper limit is reached. Such reduction will be made gradually and ample opportunity given the stockmen to fit their business to the new conditions. The result of the forest reserve regulations will be thus to protect the stockmen in a better and more permanent use of the ranges.

Forest Reserve Notes.

The Plumas Forest Reserve in California, was created on March 27th, with an area of 579,520 acres. Forest Inspector L. A. Barrett has been appointed forest supervisor of the reserve.

Forest Inspector W. R. Slosson has been appointed forest inspector of the entire Santa Barbara Forest Reserve in California. He was formerly in charge of the eastern division only, and now takes charge of the western division as well. The latter was formerly in charge of Forest Inspector B. F. Chawshaw, who is now engaged in the examination of lands in southern California for new forest reserves.

The Pinal Forest Reserve, Arizona,

recently created, embraces an area of 45,760 acres, located just south of Globe, and has been placed in charge of Forest Supervisor Thomas Hampton, who is also supervisor of the Mt. Graham Forest Reserve, with headquarters at Thatcher, Arizona. Ranger James C. Brodie has been transferred from the San Francisco Mountains Forest Reserve to this reserve.

The following new reserves have been recently created by presidential proclamation: The Trinity Forest Reserve, in California; the Wenaha Forest Reserve, in Oregon and Washington; the Chesninnus Forest Reserve, in Oregon; the Gunnison Forest Reserve, in Colorado. The Plum Creek and South Platte Forest Reserves, in Colorado, have been combined with the Pikes Peak Forest Reserve, together with other additional new lands. The combined reserve will be known as the Pike's Peak Forest Reserve. The Leadville Forest Reserve, in Colorado, and the Elkhorn Forest Reserve, in Montana, are also very recent additions to the public forest reservations.

Another new forest reserve recently created by presidential proclamation is the Sevier Forest Reserve, in Utah.

Mr. W. A. Langille has been appointed forest inspector in the Forest Service, and has been assigned to take charge of the Alexander Archipelago Forest Reserve, in Alaska.

Timber Sales in Forest Reserves. Considerable business has been done by that branch of the Forest Service which has charge of the sale of timber on the forest reserves, during the last few months. The heaviest sales of timber have been in the Black Hills Forest Reserve in South Dakota, where a removal of all of the insect-infested and diseased timber, including that destroyed by the bark beetle, is being attempted, and such timber in the shape of fuel-wood, fence posts, ties, etc., finds a ready market. Especially is the Forest Service pleased over the coöperation and assistance which residents of the reserve have shown in the removal and sale of tim-

ber; mining companies have purchased large quantities of dead timber for fuel, notwithstanding the fact that they could probably procure coal at nearly the same cost in the end. A branch of Burlington system has purchased considerable timber, where the same was sound enough to permit of its utilization as cross ties, and in general something more than one-half of the amount received during the last fiscal year has been received on account of the sales in this one reserve.

In the other reserves timber sales have been very much scattered, and the cash receipts in the several reserves, while considerable in the aggregate, no particularly large sales have been made in any one of the reserves, with the exception of the Medicine Bow Reserve, in Wyoming, where quite a large amount of tie timber has been sold, and sales are pending involving large amounts of timber to be used by mining companies as props.

As the irrigation projects being pushed forward by the Reclamation Service assume more definite shape, the Forest Service expects to sell large quantities of the timber from the eastern portion of the Yellowstone Forest Reserve, and, in fact, has in prospect considerable sales depending upon the progress of the various irrigation projects that will affect that portion of the country. As these projects develop throughout the arid West, the Forest Service is anticipating a very large increase in its timber sales, and they are preparing to meet this demand by providing a supply. Indications are that a very much larger amount of timber will be sold during the coming year than ever before, and the only really disheartening feature is that where the Bureau of Forestry can afford to sell timber, the demand for it at the present time is slight, as for instance, in Oregon and Washington, where speculators who have acquired timber through the Timber and Stone act, can afford to sell timber at less than its real value, and thus keep prices down below the mark where

the government feels it can afford to sell. In many cases timber realized from private holdings more than supplies the demand, and would make governmental timber sales unprofitable. Also the speculator in his sale of timber, takes only the cream of that on the land he has fraudulently acquired, and leaves the best possible conditions for fire. Naturally he also differs with the government as to the amount of timber which it is necessary to leave on the land for reproduction.

The Forest Service has also been gratified with the progress made in the prevention of forest fires, and the cheerfulness with which residents or neighbors of a forest reserve assist in fighting fires, and in general cooperating with the forest rangers. The Service finds that the people who buy timber in the reserves, or have privileges therein, are always ready to take hold with the forest officers to subdue fires, and are willing to make almost any exertion to help them in fire fighting.

Second Growth Long- Leaf Pine.

The longleaf pine scene in the accompanying illustration is interesting as showing the inclination of this tree to reforest tracts where it has a chance. It is from a photo by Mr. Romeyn B. Hough, author of "American Woods," taken recently in eastern North Carolina. Before enactment of the present stock laws of North Carolina and stock was at liberty to wander everywhere, the seeds of this tree, with their conspicuous wings, were coveted morsels and quickly devoured, especially by hogs. Now the hogs are not allowed such extensive liberty and are kept out of the tract in question, so that the seeds have had a chance to germinate with the result shown in the picture. In the middle of the field are shown a few old trees, doubtless the parents of those about them. Scattered throughout the foreground are many seedlings, all of this species, just appearing in the grass, and ranging to the height of one's shoulder, and in

the background is a nice forest growth a number of years older, perhaps ten years old. Such scenes as these are common in southeastern North Carolina, millions of little pines of this species and the loblolly pine springing up wherever cultivation is neglected and stock excluded.

Thirteenth Irrigation Congress. The Thirteenth National Irrigation Congress will be held at Portland, Oregon, August 21-24. Governor Pardee, of California, is president of this con-

tion was adopted to the effect that it will endeavor to raise a fund of not less than \$100,000 as an endowment for this purpose. A committee was appointed to carry on the work of raising the money.

This decision to raise funds for the support of a chair in forestry was the outcome of a plea made before the convention by Mr. Gifford Pinchot.

The success of this move will supply instruction of the most valuable kind for young men taking up the pro-



Photo by Romeyn B. Hough.

Longleaf Pine Reforesting a Field Where Cultivation Has Been Neglected.

gress; Mr. C. B. Booth, of Los Angeles, chairman of the Executive Committee, and Mr. Thos. Richardson, of New Orleans, is secretary. The complete program of the congress will be announced at an early date.

Chair of Lumbering.

The Yale Forest School is likely to have a chair of lumbering at a reasonably early date. At the annual meeting of the National Lumber Manufacturers' Association a resolu-

tion of forestry. Further, it is remarkably significant of the growing interest lumbermen are coming to have in the practice of forestry.

Forester Wanted.

The Cleveland - Cliffs Iron Company, whose forest lands are located in northern Michigan, are considering the employment of a trained forester. He will be charged with recommending a detailed and definite forest policy for the management of the forest lands

of the company, and so far as it is approved, will put it into effect. His salary will be \$2,500 a year in the beginning. Those desiring to apply for this position should address such applications to Mr. Gifford Pinchot, Forester, U. S. Department of Agriculture, Washington, D. C.

Prominent Men and Forestry. The interest manifested in the Forest Congress, held at Washington, D. C., in January, has been so great that the Bureau of Forestry has issued a circular containing portions of each of the speeches there delivered. It is intended to spread this circular widely, since it serves to show the opinion of prominent men who have to do with forests and forest products in regard to the application of practical forestry. The publication contains merely extracts of the speeches delivered, and is in no way a complete record of the proceedings of the American Forest Congress. Such a volume is to be issued shortly by the H. M. Suter Publishing Company, of Washington, D. C. The Bureau's circular is being sent to a large list of teachers, lumbermen, legislators, and in general those interested in forest work, and it is hoped that it will pave the way to a closer communication between the Bureau of Forestry and the people of the country.

In this connection, the Bureau of Forestry announces that it desires the name of every person interested in forestry in this country for its mailing list. Such persons will receive the more important of its publications, as they are issued from time to time. It is manifestly impossible to send every publication issued by the Bureau to such a large number of people, but those of general interest will be distributed widely, and all who especially desire it, can be placed on a list so that they will receive notices of special publications as they are issued.

Revision of Forest Policy. During the short time since the Bureau of Forestry was placed in charge of the Forest Reserve work in

this country and the administrative work connected therewith, it has been endeavoring to ascertain the weaknesses of the old system of regulations, and endeavoring to discover where improvement might be made in the existing policy of administration. While there has been no public announcement as yet, it is understood that the Bureau will shortly issue a revised manual of regulations, and define its policy in regard to the forest reserves. Such revision will in general be based upon the following points:

Heretofore delays, involving in many cases financial loss, have been occasioned by long-range management of the reserves from Washington, and yards of red tape have bound local reserve officials, so that the smallest privileges were only obtained after lengthy delay and voluminous correspondence. It is now proposed to effect a reform in this respect, whereby the reserve officials will be empowered to dispose of the smaller matter that need attention without direct authorization in each case, being secured from the offices in Washington. This means increased responsibility, and with it additional pay for forest reserve employees.

Control of the reserves will hereafter be more by inspection and less by reports, as in the past. Efficiency will be judged more by results than by methods. In the reserves themselves, provisions are being made for much fuller use of all resources by the people. The sale of timber will be encouraged; free timber will be given those in need of it but unable to buy. The law which has hertofore prohibited the exportation of timber cut in a forest reserve to any other state outside of that in which the reserve is located, has already been repealed by Congress, except in Idaho and the Black Hills Forest Reserve, in South Dakota.

A special study of range conditions will be made to fix the maximum safe amount of grazing on the reserves, and in general all legitimate business enterprises which will not injure the re-

serves will be facilitated and encouraged, with the least possible red tape requirements.

Such a policy is well calculated to enlist the support of the people in the forest reserve idea. Heretofore such strict restrictions have been imposed in the public's utilization of forest reserve privileges and such long delays occasioned by unavoidable red tape methods, that they have come to regard the reserves as a menace to their welfare, instead of a benefit conferred upon them by the government. The new policy will go far toward inducing a change of sentiment in this regard.

Reclamation Service Personals. District Engineer Geo. L. Swendsen, Salt Lake City, has been directed to continue the hydrographic measurements in Utah which bear upon the various projects, and to take up negotiations with land owners with the objects of bringing to a definite conclusion the early construction of the project determined upon.

The legal department of the Reclamation Service is prepared to give all needed assistance to the water users interested in the Strawberry Valley project in forming the necessary water users' association.

Mr. Harry E. Essley and Mr. Edward R. Furstenfield, both residents of Colorado, have been appointed as bookkeepers and assigned to duty under Engineer I. W. McConnell, at Montrose, in connection with the Uncompahgre Valley project.

Mr. H. A. Comstock, Engineering Aid, Reclamation Service, has been assigned to hydrographic work in South Dakota, and ordered to report to Mr. Raymond F. Walter, Belle Fourche, on April 1st. Mr. Comstock's home is in Vermont.

Mr. Elver L. Shinhur, of Colorado, has received an appointment as Engineering Aid and ordered to report to I. W. McConnell at Montrose, where he will be engaged in connection with the Uncompahgre Valley project.

Mr. R. W. Hawley, Assistant Engi-

neer, has been assigned to work in Nevada, and ordered to report to District Engineer L. H. Taylor, at Hazen. He will be engaged upon drafting work in connection with the Truckee-Carson project. Mr. Hawley's home is in New York, and he is a graduate of the Colorado Agricultural College, having taken a course in irrigation engineering.

The Reclamation Service is planning a very busy season in the North Platte Valley in connection with the work on the North Platte project. The engineer in charge, John E. Field, has directed a number of parties to proceed to the field as soon as conditions permit. At the present time the assignments from the Civil Service to the project includes: One assistant engineer with experience on topographic work; ten engineering aids, three of whom it is intended to train for topographic work on canal surveys; two experienced level men; one constructing engineer draftsman; one topographic draftsman; two assistant engineers, with experience on construction; four assistant engineers, to act as instrument men for last named assistant engineers.

Mr. A. P. Davis, Assistant Chief Engineer of the Reclamation Service, now in the West visiting the several Government projects, will devote considerable personal attention to the various schemes for reclamation in Washington, Oregon, Utah, Idaho, Nevada, Colorado. Under instructions of Chief Engineer Newell he will hold several meetings with boards of engineers in these States, and during his stay will endeavor to meet and discuss important questions with the prominent citizens interested in the various projects.

Mr. Benjamin Franklin, of Ft. Collins, Colorado, will enter the employ of the Reclamation Service on May 15, 1905, as masonry inspector, and will be detailed to the Belle Fourche project, South Dakota.

Mr. Goyne Drummond, one of the best known reconnaissance men con-

nected with the Reclamation Service, has been directed to report to Mr. Cyrus C. Babb, engineer in charge of the Milk River project, to take up the reconnaissance work on Swift Creek, Kennedy, and Boundary Creeks, tributaries to the St. Mary River.

Mr. E. H. Baldwin, who was appointed Constructing Engineer, left Washington April 3, to report to Mr. C. E. Wells, at Casper, Wyo., for duty on Pathfinder reservoirs. Mr. Baldwin is a graduate of Cornell University and was engaged in 1892 as engineer and superintendent of grading new streets in Seattle, Washington. Since that time he has been with the Omaha Canal and Power Co., Omaha, Neb.; Fall River Water Works Co., Mass.; City Engineer's Office, Newton, Mass.; Sewer Div., Street Department, Boston, and from November, 1895, to date, with Metropolitan Water and Sewerage Board of Boston, Mass.

F. W. Huber, Assistant Engineer, now at Berkeley, Cal., will be transferred to L. H. Taylor, Hazen, Nevada, to carry on tests of cement. Mr. Huber was born in Virginia and attended the Baltimore City College and Cornell University. He was engaged in various engineering capacities by the United Railways of Baltimore and the Baltimore and Ohio Railroad Co., up to May, 1903, when he received an appointment as Engineering Aid in the Reclamation Service.

H. C. Hurd, Assistant Engineer, resigns from the service to accept position under Peruvian Government. Mr. Hurd graduated at Princeton and spent some time on the construction of the Broadway Cable road, New York City. He was subsequently engaged with the Nicaragua Canal Commission, the Isthmian Canal Commission, Washington & Annapolis Electric Ry. Co., and as special agent of the State Department on work on Nicaragua Canal Route.

H. T. Paterson, Assistant Engineer, attended Rose Polytechnic Institute, Terre Haute, Ind. Will be transferred

from Hazen, Nevada, to Roswell, N. M., to succeed H. C. Hurd, resigned. Mr. Paterson, who had a course in special work at the Missouri School of Mines, was engaged on ditch construction for the Taylor-Park Gold Mining Co.; as assistant city engineer, Colorado Springs; with the Colorado Springs Rapid Transit Co., and with the Denver and Rio Grande Railway. Entered Reclamation Service in October, 1902.

A. P. Morris, Draftsman, will report at Belle Fourche, S. D., for duty, May 1st. Transferred from Washington office.

Jos. H. Root, clerk, transferred from Nautical Almanac Service, Naval Observatory. Has been ordered to report for duty at Hazen, Nevada.

H. P. Seidemann, clerk, transferred from Washington office to Belle Fourche, S. D., for disbursing duties in connection with Belle Fourche project.

A. I. Stiles, Engineering Aid, resigns from service to accept position under Peruvian Government. Mr. Stiles attended the Stanford University, California, and has been connected with the Coast and Geodetic Survey, making two trips to Alaska; also with the Examiner of Surveys, General Land Office.

Chas. E. Slonaker, Observer. Assigned to work under the direction of P. M. Churchill, N. D. Mr. Slonaker was transferred to the Reclamation Service from the U. S. Weather Bureau in 1903.

In order to expedite the preliminary work on the Crow Indian Reservation, the following have been assigned to Engineer Robert S. Stockton, in charge of the reclamation work: C. S. Steiner, L. M. Hatch, Assistant Engineers, and T. M. Gardner and A. M. Bonillon, Draftsmen.

With this addition to the regular force employed it is hoped to finish up the general reports and estimates on the definite projects in the reservation about April 15. The work on the Ft. Custer project is about com-

pleted. The Waco Sanders project will require some additional field work before estimates can be made for the three systems it involves. The first of these includes the Waco ditch, covering 4,000 acres, the Big Horn Junction ditch, 1,500 acres, and a low line gravity canal for the Sanders land covering 13,000 acres, thus giving a total of 18,500 acres under the gravity system.

The second system includes the Waco power and irrigation canal and Sanders and Big Horn Junction pump lines, with a total of 23,100 acres.

The third system includes the Sanders low line gravity canal, 13,000 acres; Waco power and irrigation canal, 4,500 acres, which will supply power to pump from the Sanders low line with a seventeen-foot lift, to cover 5,000 acres, and to pump with a fifty-foot lift to cover 5,000 acres, also to cover the Big Horn flats near the junction of the rivers by a gravity ditch aggregating about 5,000 acres. The surveys have not been made on all of the canal lines, so that estimates of cost at this time are not possible.

The following is a list of the engineers, aids and assistants now under S. B. Robbins, engineer in charge of the Sun River project, Montana:

Preliminary Surveys—F. F. Prendergast, assistant engineer in charge of party; W. R. Ewings, engineering aid, plane table; John C. Cleghorn, engineering aid, instrument man and draftsman; W. C. Newlon, station assistant, Chas. Gordon, rodsman, plane table; Wm. Throm, rodman, plane table; John P. Nelson, rodman, level and transit; Harry Lloyd, axeman; Geo. W. Sherman, Jr., teamster; John Forrest, cook.

Location Surveys—Geo. W. Wood, field assistant, in charge of party; Gordon Edson, engineering aid, transitman; C. E. Shipman, engineering aid, draftsman and topographer; John A. Byron, head chainman; Roy Thomas, rear chainman; F. G. Lewis, back flagman; G. W. Merrill, axeman; Arthur Lambie, axeman; R. W. Randall, level-

man; Fred Stewart, level rodman; G. W. Sherman, cook; T. S. Newman, teamster; John Scott, teamster.

Reservoir Surveys—Willis T. Turner, topographer, in charge of party; Arthur P. Porter, engineering aid, instrumentman; F. W. Bird, station assistant; Henry Heinrichs, rodman; Herman Maurer, rodman; F. W. Tozer, cook; Robert Palmer, packer.

The Chief Engineer of the Reclamation Service has accepted the resignation of Mr. William Swift, engineer, effective May 1, 1905. Mr. Swift resigns to accept a position with the Isthmian Canal Commission as resident engineer at \$3,600 per annum. He will be allowed 15 per cent. of his salary as a commutation for the maintenance of quarters, free transportation from New York or New Orleans to the Isthmus, six weeks' leave of absence on full pay, medical and hospital service in case of illness, and upon the termination of his services with the Commission will be accorded free passage back to this country.

Mr. Swift, who was born in Connecticut, graduated from the Massachusetts Institute of Technology with the degree of B. S. He has been engaged in various engineering capacities since 1895 with the Boston Water Works, Metropolitan Water Works, Boston; Munson Steamship Line, N. Y.; Rapid Transit Railroad, New York City, in charge of construction of subway; February 24, 1903, engineer in Reclamation Service.

Mr. Swift's services have been eminently satisfactory and his departure from the Reclamation Service is reviewed with regret by his superior officers and by the men who have been engaged under him on engineering work in Montana.

The Secretary of the Interior has executed a contract and approved the bond for the installation of a steam-heating plant in the eight-room school building to be erected in the city of Hobart, Oklahoma. The contract was secured by F. B. Hannan & Company, of Lawton, Oklahoma.

A NEW SPECIES OF JUNIPER FOR TEXAS

BY

GEORGE B. SUDWORTH

Dendrologist, Bureau of Forestry

ELEVEN species of junipers, or "cedars" as they are more commonly called, are indigenous to the United States. Two inhabit the east-

of the Rocky Mountain and Pacific regions. With few exceptions, they are trees of poor dry soils, often the only growth on elevated plains



Fig. 1. *Juniperus Pinchoti*, Showing Habit of Growth.

ern half of the country, one extends across the continent, while the remainder are distributed for the most part over dry foothills, mesas, and slopes

and slopes far distant from the timber forests at higher altitudes.

Two of the eastern species have reddish heartwood which is exception-

ally durable in contact with the soil and exposed to the weather, posts and fence rails having been known to last forty to sixty or more years. With one exception, the western junipers have a light brown heartwood which is much less durable in an unprotected state than the redwood of the eastern species. Our eastern redwooded junipers are well known both in this country and abroad through their extensive use for pencil wood, while on account of their extreme lasting qualities, the timber is greatly prized also



Fig. 2. Fruiting Branch of *Juniperus Pinchoti*.

for posts and telephone poles. The usefulness of the western junipers is practically unknown, except locally. In very many localities their abundant growth is the mainstay of the rancher both for fuel and for fencing; and in not a few instances the fuel of small foothill towns is derived entirely from near-by juniper. As yet little if any attention is paid, however, to preserving for the future the productiveness of these most important stretches of woodland. A point of interest in this

connection is that with the nearly exhausted supply of eastern pencil wood, makers are earnestly seeking substitutes, for which at least one of the western junipers is likely to serve.

The following is a description of a newly discovered species of juniper:

Juniperus pinchoti sp. nov.—As now known, a tree ten to twenty feet in height with numerous stems, three to five inches in diameter, forming more or less dense clumps (fig. 1). The thinnish bark of the trunk is broken longitudinally into narrow, anastomosing scales, which are long persistent. Exteriorly the bark is ashy-gray and a dull cinnamon brown on the inner surface. The bark of the small branches is often divided transversely into long narrow scales. Branchlets somewhat rigid in appearance (fig. 2); those of pistillate trees slender to moderately stout on staminate individuals. Leaves yellowish green usually in threes, but often in twos; closely appressed, acute, thickened, keeled and commonly marked with a depression or glandular pit on the back; about one-tenth of an inch long. Leaves of the young shoots linear-lanceolate, very sharp-pointed, spreading at the tips, one-fourth to one-half an inch long, and with a conspicuous resinous gland on the back (Fig. 3). Flowers and fruiting habit insufficiently known at present; probably a species which matures its fruit the second year after flowering. Mature fruit one-fourth to three-eighths of an inch in diameter, subglobose to slightly oblong, distinctly reddish or copper-brown, with very little or no bloom. Fruit with thick, dry, sweetish flesh and one or two seeds, which are indistinctly ridged, broadly ovate, pointed, lustrous chestnut brown at the apex (hilum very large and bilobed). The wood (not yet technically studied) has distinct narrow rings. Sapwood nearly white and heartwood light brown with a pale reddish tinge; only moderately durable in contact with soil.

The range of this juniper is not



Fig. 3. Sprouting Habit of *Juniperus Pinchoti*.



Fig. 4. Habitat of *Juniperus Pinchoti*.

fully known, but it has been found growing abundantly in Paloduro Canyon in Briscoe, Randall and Armstrong counties, Texas, associated mainly with the One-seed Juniper (*Juniperus monosperma*). The latter species is confined chiefly to steep slopes and broken ground, while the new species is spread over flat bottoms and grassy mesas where there are only a few inches of baked soil over rocks (Fig. 4). The stems of both species are easily killed by the frequent fires of the region from which the One-seed Juniper does not recover, gradually disappearing from burned areas. The new species, however, possesses a marvelous power of sprouting from charred or cut stumps, thus persistently renewing itself and occupying fire-swept localities often to the exclusion of other woody plants. The sprouts spring up in dense clusters (Fig. 3) and grow rapidly for a few years, and then slowly until they attain their full height. Evidence was found of the third generation of sprouts, growing vigorously after fire.

The persistent sprouting of this species after fire renders it of very great importance forestrally, in dry regions, since it may be depended upon to renew itself both after cutting and burning. The wood is locally used for fuel and for fence posts.

Credit is due in this connection to Mr. George L. Clothier, of the Bureau of Forestry, who first observed this tree in 1903, and called my attention to its unique and characteristic habit of growth which distinguished it from other junipers of the region. Credit is also due to Mr. H. H. Chapman of the same service, who, a season later, collected additional herbarium specimens and supplied further information concerning the habits and range of the tree.

This species is named in honor of Mr. Gifford Pinchot, whose keen appreciation of the importance of field forest studies made possible the investigations which led to the discovery of this tree.

RECENT IRRIGATION LEGISLATION

Resume of What Was Done at Last Winter's Sessions of the Legislatures in the Irrigation States and Territories

ALL the Legislatures of the irrigation States and Territories held their biennial sessions during the last winter. The interest in irrigation matters in general, and in the Reclamation Service in particular, is shown by the fact that in nearly every State and Territory in the west, legislation in one form or another has been passed with a view to aiding in irrigation development and in the construction of irrigation projects by the Government under the provisions of the Reclamation Act.

ARIZONA.

The Legislatures of this Territory and of Kansas are among those in which irrigation work is carried on to any extent that do not appear to have enacted legislation affecting irrigation.

CALIFORNIA.

Four acts were passed by the Legislature, involving matters concerning irrigation and forestry; namely:

- I. An act to coöperate with the United States in the construction of

the Klamath Project, lying both in Oregon and California, by authorizing the United States to change the level of certain lakes lying partly in California and Oregon, and also to cede to the United States any claims which the State may have to lands uncovered by the lowering of the water levels of said lakes. Approved February 3, 1905.

2. An act approved March 20, 1905, appropriating for the period of two years the following sums for coöperation; with the United States Geological Survey for topographic maps, \$30,000; gaging streams, determining underground water supplies surveying reservoir sites, etc., \$20,000; investigating the economic quality and purity of water, \$1,000. For coöperation with the Bureau of Forestry: for studying forest resources and the proper conservation of forests, especially with a view to formulating a proper State policy, \$10,000. With the Office of Experiment Stations of the United States Department of Agriculture, for ascertaining the best method of distributing and using water, \$15,000. These appropriations are made upon the condition that the proper authorities of the United States shall expend at least an equal amount for the same purposes.

3. A general Forestry Act approved March 20, 1905, providing for the appointment of a State Board of Forestry, also of a State Forester, specifying his duties, authorizing him to appoint subordinate officers, and providing, in general, for an appropriation of \$8,800 per annum for the next two years.

4. On March 21, 1905, an act was approved to create a drainage district to be called the Sacramento Drainage District, and to provide, in general for the reclamation by drainage of a certain described district in the valley of the Sacramento River and its protection from floods.

COLORADO.

Definite returns have not been re-

ceived. It is understood, however, that a bill has been passed providing for a State Board of Land Commissioners for the selection, sale, leasing, and management of State and school lands.

This bill as under consideration provides for the sale to the United States, at a price not to exceed \$3.50 per acre, of right of way over State lands for irrigation works, other than canals, tunnels, pipe lines, transmission lines, etc. It also authorizes the State Board of Land Commissioners to sell State lands in conformity with the plans for the disposition of the lands of the United States under reclamation projects.

It provides, further, for a right of way for canals, tunnels, pipe lines, transmission lines, etc., over State lands without charge. An act was passed amending the irrigation district law in regard to the method of taxing the lands in the district, known as the Church Irrigation Bill.

IDAHO.

There have been some modifications of the former very complete irrigation law of the State—among them, a provision to diminish the time in which it will be necessary to begin work upon the structures required to utilize water appropriated under the law; also in cases involving large enterprises, a bond must be filed with the State Engineer for the completion of the works necessary to utilize the water. Provision is also made to increase the duty of water.

A law was passed providing that the State may contribute by annual payments toward the cost of constructing works under irrigation districts where the State lands are benefited.

The former act in regard to the provisions of the Carey Act by which the State would undertake to give deed to the irrigation corporations for the lands not sold within a certain time has been modified so that such deed shall only be issued to actual settlers and thus the State legislation

is placed in harmony with the intent of the Federal statute.

KANSAS.

No returns have been received.

MONTANA.

A bill was approved March 2, 1905, providing for the judicial procedure for the adjudication of water rights under irrigation systems.

An act was approved February 27, 1905, making certain special provisions regarding the appropriation of water by the United States, allowing three years for beginning the construction of the irrigation works.

An act approved February 28, 1905, provides that State lands under projects constructed by the Reclamation Service, shall be sold in conformity with the system established by the government for the disposition of public lands under the project.

The act of March 2, 1905, authorizes the United States whenever it is desired to enlarge any existing ditch for use in connection with a reclamation project, to condemn such right of way and to enlarge the ditch and use it in connection with the owner.

NEBRASKA.

By the act approved March 2, 1905, the sum of \$5,000 is appropriated for the years 1905 and 1906 for coöperation with the United States Department of Agriculture in irrigation and drainage investigations in association with the Nebraska Agricultural Experiment Station, upon condition that an equal or greater sum will be spent by the United States for this work.

By the act of April 3, 1905, right of way is granted over lands belonging to the State for ditches, tunnels, transmission lines, necessary in connection with irrigation works constructed by authority of the United States.

An act was passed and approved April 3, 1905, prohibiting the sale of liquor within five miles of any camp or assembly of men where twenty-

five or more men are employed, engaged in the construction of any railroad, canal, reservoir, public work, or other kindred enterprise.

The act of April 3, 1905, provides for certain amendments of the law providing for the establishment and management of irrigation districts.

By the act approved April 1, 1905, provision is made to facilitate the filing of stock subscriptions of water users associations organized in conformity with the requirements of the United States under the reclamation act. The effect of this act is to provide for nominal recording fees for these documents, which are necessarily voluminous.

NEVADA.

By the act approved March 19, 1905, the State provides for right of way over its lands for ditches, telephone and transmission lines, constructed by authority of the United States. It provides, further, for the sale of State lands lying within projects under the reclamation act in conformity with the conditions of disposition of the public lands of the United States. It also provides for nominal charges for the recording of subscriptions to stock of water users associations organized in pursuance of the requirements of the United States under the reclamation act.

The act approved March 16, 1905, amends the irrigation law of 1903 in regard to the qualifications and appointment of State Engineer, omitting the requirement that nominations for State Engineer shall be made by the Secretary of the Interior.

The act approved March 1, 1905, is both amendatory of, and supplemental to, the irrigation act of 1903. Section 2 of that act, fixing the maximum amount of water allowed at 3 acre-feet per acre per annum, was repealed, and the provision requiring the Board of Irrigation to ask the Secretary of the Interior or the Director of the Geological Survey to nominate water commis-

sioners was eliminated. New sections were added, providing for the complete control of new appropriations by the State Engineer, and a regular legal procedure was provided for the severing of the water right from land on which irrigation had become impracticable and the removal thereof to new land.

NEW MEXICO.

An appropriation of \$2,500 is made from certain funds of the Territory relative to irrigation and reservoir construction to assist in the organization of a water users association under the Rio Grande Project of the Reclamation Service. This act was approved March 13, 1905.

An act was passed covering, in general, the appropriation of water, and providing for a Territorial irrigation engineer; approved March 16, 1905. The act provides that the Territorial irrigation engineer shall at the request of the proper officer of the United States authorized by law to construct irrigation works, set aside from further appropriation under the laws of the Territory any unappropriated waters which may be needed for such government works.

Another act of March 16, provides a method of appropriating water for mining, milling, agriculture, and other useful purposes.

Another act approved March 16, provides for the protection of ditches, pipe lines, reservoirs, etc., from injury, and also prevents pollution of waters used for domestic purposes.

An act approved February 22, 1905, provides for the regulation of the use of artesian wells and prevents waste of subterranean waters.

NORTH DAKOTA.

The Legislature passed a general irrigation code, following, substantially, the draft of irrigation code prepared last fall by the Reclamation Service, providing for a State Engineer, for adjudication of water rights, and for the regulation of water appropriations.

This code was approved March 1, 1905, and provides, further, for the appropriation of the waters of the State where needed for reclamation projects by the United States, allowing a period of three years for beginning construction. It provides, also, for right of way over State lands for irrigation works constructed by authority of the United States, and also that State lands within reclamation projects shall be disposed of in conformity with the provisions for the disposition of public lands.

An act was passed providing for the filing of stock subscriptions to water users associations organized in conformity with the regulations of the United States under the reclamation act, at a nominal fee. This act also contains general provision for right of way over State lands for irrigation works required by such water users associations, and, in addition, authorizes the State and other municipal organizations to join the water users associations when they own land under the project.

An act was passed providing a nominal fee for the organization of water users associations formed in connection with Reclamation projects.

OKLAHOMA.

A bill was passed providing for cooperation with the United States Geological Survey for a topographic survey of the Territory, an appropriation of \$5,000 per annum being made to be spent in connection with an equal amount to be allotted by the government.

The Legislature passed a general irrigation code similar to that passed by the State of North Dakota, establishing the office of State Engineer, providing for water appropriations by the United States, for right of way over Territorial lands, and for the disposition of Territorial lands in conformity with the requirements of the government where the same are included in reclamation projects. This act also provides for the filing at a

nominal fee of the stock subscriptions of water users associations under reclamation projects. Although the office of State Engineer is established, it is provided that until an appointment is made, the Secretary of the Board of Agriculture shall perform the duties of that office.

OREGON.

By the act approved January 20, 1905, the Reclamation Service was authorized to utilize Upper and Lower, or Little, Klamath Lakes, Tule, or Rhett Lake, and Goose Lake, in connection with the irrigation operations of the government; and the State ceded to the government all its right, title, interest and claim to the lands uncovered by the lowering of said lakes.

The Legislature passed an act regulating appropriation of water by private parties, providing for appropriations by the United States, and allowing four years for the beginning of construction. Provision is also made for the adjudication of water rights. The office of State Engineer is established. An appropriation of \$2,500 annually for two years is made for coöperation with the United States for hydrographic surveys, and an appropriation of \$2,500 for coöperation in topographic surveys, upon condition that the United States shall make a like apportionment for such purposes. The act provides that State lands within reclamation projects shall be disposed of in conformity with the provisions of the government for the disposition of its lands. The act also provides for right of way for irrigation works constructed by authority of the United States over State lands.

The Legislature also passed a bill providing for the organization of an irrigation district in connection with the Malheur Project of the Reclamation Service. This bill authorizes the issuance of bonds for the purchase of water rights which might be found necessary in connection with said project.

SOUTH DAKOTA.

On March 3, 1905, the Legislature passed a general State irrigation code, providing for a State Engineer and similar, and general, to the provisions of the North Dakota irrigation code.

TEXAS.

In recognition of the fact that Congress had extended the provisions of the reclamation act to this State, so far as may be necessary in connection with the Rio Grande Project, the Legislature passed an act providing that the United States might exercise within the State all necessary powers for carrying out the provisions of the reclamation act.

UTAH.

The irrigation code of 1903 was reenacted with certain amendments, in order to avoid the possibility of the form of the previous act being declared unconstitutional. There are very few changes of importance in this code. A provision has been inserted exempting the United States in its irrigation construction from the operation of certain sections relating to the examination and inspection of irrigation works by the State Engineer while in process of construction.

WASHINGTON.

An act was passed authorizing the Commissioner of Public Lands to reserve from appropriation the waters required by the United States for reclamation projects, and allowing four years for beginning construction to utilize the same. It provides, also, for right of way over lands belonging to the State for irrigation works constructed by the United States. Said act also provides that State lands within irrigation projects shall be sold in conformity with the provisions for the disposition of the public lands of the United States.

WYOMING.

By the acts of February 8 and 15, 1905, certain minor amendments of

the irrigation law were made. Another act approved February 15, 1905, provides for the condemnation of reservoir sites by any party desiring to construct a reservoir for irrigation or other purposes. Another act of February 15, 1905, provides for a commission of three persons to be appointed by the governor to serve, without compensation, for the purposes of codifying and simplifying the laws of Wyoming relating to water rights.

Another act of February 15, 1905, provides for the limitation of the right to the use of water to the amount required for beneficial use and that the owners of ditches, canals, or reservoirs having a surplus of water and furnishing the same to others shall

be considered common carriers and shall be subject to the same laws that govern common carriers.

The act of February 20, 1905, provides for the protection of roads and highways from flooding from irrigated fields and irrigating ditches.

The act of February 21, 1905, relates to the time for the commencement of construction of irrigation works.

Another act of February 21, 1905, prohibits the transfer of water rights when the change would be injurious to other persons, requires the recording of all deeds of transfer of water rights and for injunction proceedings in case of wrongful interference with valid transfers.

GOVERNMENT EMPLOYEES MUTUAL RELIEF ASSOCIATION

There was recently formed at Washington, D. C., an organization that is to be known as the Government Employees Mutual Relief Association. The officers are: President, F. H. Newell, Chief Engineer of the Reclamation Service; vice-president, James B. Adams, Bureau of Forestry; secretary, H. B. Cramer, Geological Survey; treasurer, Mr. Denmark, Geological Survey. Executive committee: Gifford Pinchot, Forester, U. S. Department of Agriculture; Morris Bien, U. S. Reclamation Service, and Geo. Woodruff, Bureau of Forestry.

Experience has shown that from time to time government employees, whose immediate families are not well-to-do, fall sick or die at Washington or elsewhere, having and leaving no means to care for them during sickness or transport their bodies home in case of death. This situation throws expense upon those who are willing to contribute and sometimes causes great hardship.

INSURANCE COMPANIES WHICH ATTEMPT TO FURNISH RELIEF.

Pinchot, seeing the necessity for some arrangement other than mere charity to meet these extreme cases, appointed a committee to investigate and determine upon a scheme for bringing the majority of employees in the Geological Survey and the Bureau of Forestry into health and accident insurance companies. The committee found that the premiums charged by such companies were practically prohibitive so far as the majority of their employees are concerned. One example of such a health and accident policy is convincing: A company, in which many of the Geological Survey employees in particular are insured, furnishes for \$55 per year a policy which provides \$5,000 in case of death by accident with no provision whatever for death from sickness, and \$25 per week in case of total disability from accident or sickness. The \$55 premium in itself was found prohibitive and, further, the benefits do not meet the needs, because only one-twentieth of deaths occur from accident from which it can be seen that they might have many deaths per year for several years among those holding this policy

Mr. Walcott, Mr. Newell, and Mr.

and in no case secure relief from the company. Moreover, \$5,000 in case of death by accident is practically not more than \$250 in case of death from any cause, determined by the ratio 1 to 20.

REASONS FOR SUCH PROHIBITIVE PREMIUMS.

The committee then investigated through the Department of Commerce and Labor, the reasons for these high premiums. It was found that more than 40 per cent. of all premiums paid to accident and health insurance companies go to the expense and profit accounts of the companies, leaving less than 60 per cent. for benefits. In ten western states and territories in 1902, the actual losses incurred were only 46.9 per cent. of premiums paid. With such data in hand the committee readily understands how one of the leading regular companies figures 35 per cent. for agents' expenses and commissions.

PROPOSED SOLUTION OF THE DIFFICULTY.

Hence, the committee investigated means of reducing these excessive expenses if possible. It found several mutual benefit societies of different classes which succeeded in carrying on business for about 5 per cent. of premiums paid in. It therefore proceeded to plan for such a mutual relief association as would seem to cover the exact needs of the situation: eliminating absolutely all such items as agents' commissions, advertising, and rent, and reducing to a minimum administrative expenses and salaries.

The constitution and by-laws submitted provides roughly as follows:

Government to be in the hands of seven directors.

Administrative expenses outside of necessary stationery, stamps, etc., to be not greater than \$250 per year.

Membership: All government employees are eligible, classed as follows: (A) Those who are under regular appointments. (B) Temporary employees not under regular appointment.

Fees and dues are as follows: (a) An admission fee of \$1 from each new member. (b) Dues at the rate of \$12 per year; class A to pay semi-annually in advance, class B, monthly in advance.

Benefits to be as follows: (a) A disablement indemnity of \$15 per week for not more than ten weeks when members are not drawing their regular salaries, members of class B, however, not to receive more than 75 per cent. of weekly wages. (b) In addition to all other benefits—doctors', nurses', hospital, and medicine bills not to exceed \$40 per week, nor \$100 per year. (c) Death benefits as follows: 1. \$200 when a member dies at the place indicated for burial in his application. 2. If he dies elsewhere, the actual cost of preparing the body and transporting it to burial place, and \$100.

A dividend to be declared at the end of each year dividing the balance of annual dues on hand proportionately among members of class A; not in cash, however, but as a credit on the next year's dues in order to maintain a continuous fund in the treasury. Members of class B do not participate in this dividend.

THE LEWIS AND CLARK CENTENNIAL EXPOSITION

THE exhibit of the United States Forest Service and the United States Reclamation Service at the Lewis and Clark Centennial Exposition will be contained in a special building 60 by 100 feet, located on the

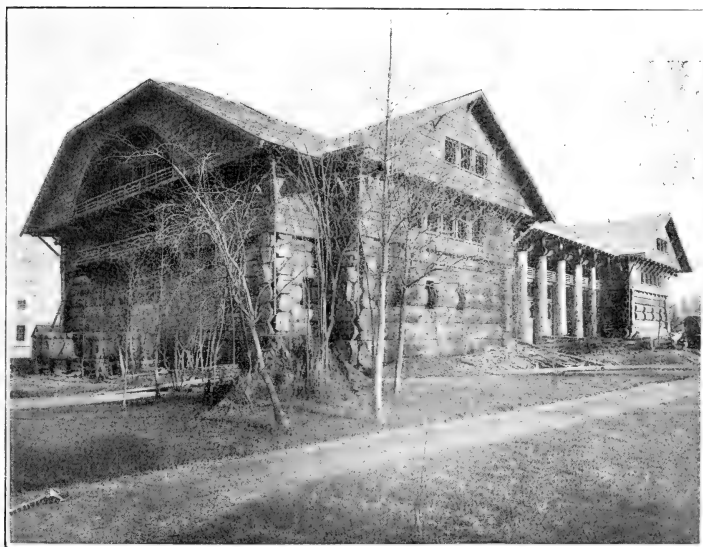
site originally assigned to the Fisheries Bureau, and in close proximity to the main government building, of which these exhibits form a part.

In general, the exhibit of both of these branches of the government is

educational in character. Prominent in both the exhibits are maps, models, diagrams, photographs, transparencies and enlarged bromide photographs, illustrating fully all general conditions, and particular phases of the work carried on by these closely allied branches. There are 32 large windows in the building; 16 will give light. On one side of the building eight of those remaining will be used by the Reclamation Service to display large transparencies, 30 by 40 inches, illustrating conditions prevailing in

encies will illustrate the various problems with which this service has to deal. In this connection, and indeed in the whole exhibit, special attention will be given to the close relationship forest cover bears to the industries directly and indirectly dependent upon water flow.

The Reclamation Service will direct attention to the importance of preventing run-off, and of the storing of water for irrigation and other purposes. The floor space of the building will be devoted to material exhibits



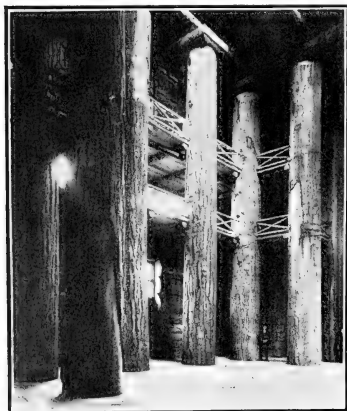
The Forestry Building at the Lewis and Clark Centennial Exposition.

the various projects under consideration, or showing special details of them. The Forest Service will use eight large windows on the opposite side of the building, displaying a large number of colored and uncolored transparencies, illustrating forests and forest conditions, types of commercial and planted forests in the forest and treeless regions of the United States, together with a large number of bromide photographs. The transpar-

of both services. The Forest Service will have material exhibits to further show its various activities. Among the prominent features here will be a display and demonstration of the government work being done in the testing of commercial construction timbers. A beam-testing machine of 200,000 pounds capacity will be in operation on the floor space. There will also be shown here the preservation of construction timbers by special treat-

ments. Methods of planting woodlots, timber tracts, shelter-belts, and windbreaks will be illustrated by a large model, showing particularly the combinations of tree species recommended by the Forest Service for various sections of the United States, in which tree planting is desirable. Various other models, charts, etc., will illustrate other special work which this service is prosecuting.

In the space allotted to the Reclamation Service, in addition to the transparencies occupying the windows, which are to illustrate the conditions prevailing in the various projects



Interior of the Forestry Building at the Lewis and Clark Centennial Exposition.

under consideration, and special phases of the governmental irrigation work, maps will show the extent and location of the various irrigation enterprises, and several of the more important projects will be represented on the floor space by working models, in which, in some cases, water is used to represent more clearly canals, lakes and laterals.

Specific and general information both relating to governmental irrigation in its entirety, and regarding each particular locality under consideration by the Reclamation Service will be

printed on large cards, 27 by 40 inches, which will be mounted in wing frames for easy access. Another special feature of the exhibit, and one which it is felt will be of especial value to homeseekers and irrigators generally, is the Bureau of Information. Mr. C. J. Blanchard, of the Reclamation Service, will be in charge of this department. He will have an office in the space allotted to the service, and is prepared to furnish all available information, to those interested, concerning the governmental reclamation work in all of the states and territories. A big supply of photographs, maps, diagrams and trite matter, showing the progress of the work of national reclamation, and with information regarding the workings of the National Irrigation Act, and each particular project in the process of construction, or under consideration, is being prepared for distribution. The exhibit of the United States Geological Survey, including that of the Reclamation Service, will be under the charge of Mr. E. T. Perkins, an engineer of the hydrographic branch, assisted by Mr. W. S. Robbins, a member of the geological branch of the survey.

Distinctly separate from the building and the exhibits indicated above, is the State Forestry Building, shown in the accompanying illustrations. The building which contains the government's display in the fields of irrigation and forestry, is to be known as the Forestry and Irrigation Building, and it should be noted that the national forest exhibit is not in the so-called Forestry Building. The latter is one of the most unique structures at the exposition. It is a gigantic log house, built of magnificent specimens of the forest wealth of Oregon and Washington, and forming in itself a goodly display.

The exhibits contained in the building partake more of the character of lumber exhibits. Specimens of the finished products of the forests of Washington and Oregon are exhibited, and examples of logging and lumbering operations indicated. In the

construction of the building no carpentry work was employed, the logs being framed together with tree-nails and old-fashioned wooden pins. The base logs of the building are six feet in diameter and 52 feet long, and above them and forming the remainder of the walls of the building, are the

rough trunks, with the bark still on, of trees of varying length, three feet in diameter. Colonnades of immense fir trees, 30 feet high and six feet in diameter, support galleries over the main entrance, and within fifty-two columns of fir and cedar trees 40 feet in length support the roof.

PROGRESS OF THE RECLAMATION SERVICE

Progress from the Various Projects Being Undertaken in the Arid West

UTAH PROJECT UNFEASIBLE.

At the request of citizens residing on Little Cottonwood Creek, District Engineer George L. Swendsen, of Utah, made an examination of a natural reservoir site on that stream, formed by a recession of the bench on either side of the creek.

The engineer reports that the dam would be about 60 feet high and 200 or 250 feet long on top. It would be a rock fill with a tunnel 200 or 300 feet long, of sufficient size to carry the flood waters of the stream, which may amount to 600 or 800 second feet. It is estimated that the dam and right of way for the reservoir would cost not less than \$30,000, and the storage capacity with a sixty-foot dam would only be 500 acre-feet.

The board of consulting engineers in session at Salt Lake, recently decided that while the project might prove feasible for a supplementary water supply on very valuable lands, neither the conditions nor the undertaking are of such a character that the reclamation fund could be used in its promotion. These recommendations have been formally approved by the Chief Engineer.

BIDS ON PART OF TRUCKEE PROJECT.

Announcement is made by the Secretary of the Interior that sealed pro-

posals will be received at the office of the engineer of the United States Reclamation Service at Hazen, Nevada, until 2 o'clock p. m., June 15, 1905, for the construction of outlet and controlling works and bridge at Lake Tahoe, Tahoe City, California, involving about 90,000 cubic yards of earth work, 500 cubic yards of concrete, etc. These proposals are for a portion of the Truckee-Carson project.

BIDS FOR LAGUNA DAM.

The Secretary of the Interior has approved the revised draft of advertisement, proposal and specifications for the Laguna dam and sluiceways in connection with the Yuma project, California.

Owing to the informality of a number of bids submitted for this project early this spring, the Secretary of the Interior rejected all bids and ordered a readvertisement.

The specifications call for the excavation of about 282,000 cubic yards of earth, about 305,000 cubic yards of solid rock, the placing of about 305,000 cubic yards of solid rock in the dam and masonry core walls, the building of 27,150 cubic yards of concrete, laying 80,000 square yards of paving, and furnishing and driving about 53,000 linear feet of sheet piling.

The bids will be opened at 2 o'clock,

Monday, June 15, at the office of the United States Reclamation Service, 1108 Braly Building, Los Angeles, California.

BISMARCK PUMPING PROJECT.

Chief Engineer Newell has directed that preliminary surveys in connection with the Bismarck, North Dakota, pumping project be pushed to completion this season, in order that the land owners in that section whose property will come under this project may have a clear understanding of all plans of the Reclamation Service, and a full knowledge of the cost of the water rights.

At the present time the sentiment of the people apparently is not generally favorable to the project. Conditions resemble those which prevailed in sections of Oklahoma, where land owners declared that any discussion of irrigation was certain to injure property values, and that irrigation was not essential anyway. A great light has dawned on Oklahoma since that time, and the people are now enthusiastically cooperating with the government in its efforts to establish irrigation works in the territory.

The past few years in North Dakota have been years of ample rainfall, and the farmers are prone to forget the periods of drouth, which, at intervals, prevail there to the destruction of crops, and certain losses to the agriculturists. It is hoped that when the completed plans are presented there will come a change of sentiment, and North Dakota will evince a readiness to cooperate with the Reclamation Service. If no such change occurs the amount set aside for the construction will be applied to works elsewhere, and the Bismarck project will be held in abeyance for several years.

WITHDRAWAL OF MONTANA LANDS.

The Secretary of Interior has temporarily withdrawn from any form of disposition whatever the following public lands in the State of Montana, under the first form of withdrawal authorized by the Reclamation Act of

June 17, 1902, in connection with the Ft. Buford project. Montana principal meridian, northwest $\frac{1}{4}$ Sec. 6, T. 19 N., R. 58 E.

NORTH PLATTE PROJECT.

The Reclamation Service is pushing work on the North Platte project with the utmost dispatch. Secretary Hitchcock has authorized the advertising of bids for the construction of the Pathfinder dam and auxiliary works at a point about 50 miles southwest of Casper, Wyoming.

The bids will be opened at the office of the Reclamation Service, Chamber of Commerce Building, Denver, Colo., at 2 o'clock, Thursday, June 15, 1905.

CONTRACT LET FOR ROOSEVELT DAM.

The Secretary of the Interior has executed a contract on behalf of the United States Government with John M. O'Rourke and Co., Galveston, and has approved the bids of the contractors for the construction of the Roosevelt dam in the Salt River project, Arizona. The contractors' bid is \$1,147,000, and the contract provides that a sufficient force and plant shall be at work within 90 days to complete the dam to a level of 150 feet above datum in the period of two years.

MAIL SERVICE IN MONTANA.

The attention of the Director of the Geological Survey has been called to the very poor mail service between Glendive and Mondak, by the engineers engaged upon the Fort Buford project. At the present time mail leaves Glendive, Montana, Mondays, Wednesdays and Fridays and goes as far as Ridgelaun, 65 miles, returning to Glendive the following day. The mail is taken from Ridgelaun the next morning after it arrives from Glendive and goes on to Mondak.

With the initiation of the construction work on this project it will be absolutely necessary that daily mail be run from Glendive to Mondak and return, a distance of 80 miles, and it is probable that a request will be made for a rural free delivery route.



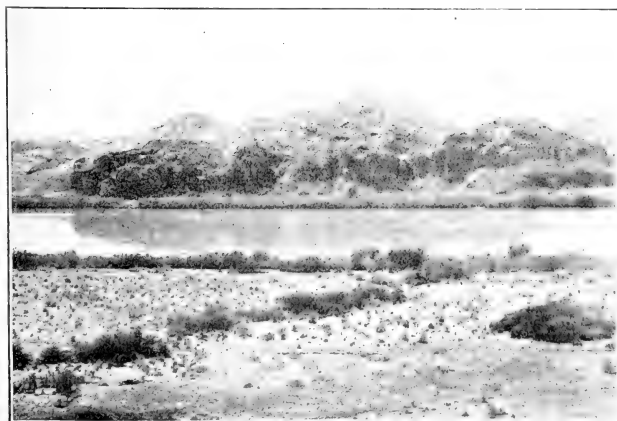
Yuma Dam Site, Colorado River, Left Abutment, Arizona.

The headquarters of the Government men and all camps are located near the stage line, but are distant from postoffices, and the present system of mail delivery causes troublesome delays and many mistakes.

LANDS FOR CLEAR LAKE PROJECT.

The Secretary of the Interior has formally approved, subject to the fu-

ture determination to construct the project, the purchase of 15,000 acres of land belonging to the Jesse D. Carr Land and Live Stock Company, at Clear Lake, Cal. The purchase price is \$187,500, and includes with it the riparian rights of the company in the Clear Lake reservoir site and along Tule Lake, besides the canals now constructed on the lands of the com-



Yuma Dam Site, Colorado River, Right Abutment, California.

pany. These lands and rights constitute an essential item and a valuable concession in the Klamath Falls project.

ARTESIAN WATER FOR LOCOMOTIVES.

Congressman Martin, of Deadwood, South Dakota, states that the Chicago Northwestern Railroad Company has under consideration the advisability of sinking an artesian well at Buffalo Gap, in Meade county, South Dakota, for the purpose of obtaining a supply of water for use in locomotive engines.

The engineers of the company have fears that if an artesian well should be obtained the water would not be suitable for engine use. Mr. Martin has requested the Geological Survey to furnish any information available on this subject.

The Director of the Geological Survey states that there are some grounds for the fears of the Northwestern Railway Company that artesian waters from the Dakota sandstone at Buffalo Gap might be too much mineralized for engine use. The waters from this source are variable in character, but it is believed that the chances are very fair that the waters at Buffalo Gap will be satisfactory, and it is thought that the prospects are sufficiently favorable to merit a trial.

COOPERATIVE WORK IN NEBRASKA.

The U. S. Geological Survey and the State Engineer of Nebraska have formulated a plan for coöperation in the collection of hydrographic data in that State. The Hydrographic Branch of the Survey, through the district office at Denver, will maintain a total of ten river stations. The State Engineer will arrange to make all neces-

sary gagings at the various stations to insure a complete and satisfactory rating curve of each, covering the range of gage heights for the year. The services of the State Engineer's assistant or assistants making these stream gagings will be paid by the United States Geological Survey.

All records of gage heights and stream gagings are to be transmitted by the observer directly to the Denver office on the regulation cards. Copies of the same are to be furnished to the State Engineer at the end of each season or year, or at any other time on request.

The travelling or field expenses incurred by the assistants of the State Engineer in securing these data are to be paid by the State Engineer's office. The Geological Survey will issue instructions concerning the method and proper manner in which all field data are to be collected, and will furnish a reasonable number of current meters which are to be used in the work.

This coöperation will insure a decided extension of the work, the importance of which is recognized by both the agricultural and manufacturing interests.

PURCHASING IRRIGATION DITCHES.

The Secretary of the Interior has approved provisionally the purchase of two canals, the Adams ditch and the Ankeny canal, in the vicinity of Klamath Falls, both of which are to be used in connection with the Klamath irrigation project in Oregon.

The Government had previously secured options on these irrigation systems, and the action of the Secretary provides for their purchase as soon as the final plans of the engineers for the construction of the large project have been accepted.



THE PRODUCTION OF MAPLE SUGAR

The Bureau of Forestry Seeks to Develop and Extend the Industry

THE Bureau of Forestry has been studying the maple sugar industry with the view of securing a larger use of the maple forests. Since 1850 the area of maple sugar farming has greatly changed and shrunk. In early days maple sugar was commonly made, even in many parts of the South, because cane sugar was virtually unobtainable. No longer is there even a limited production in South Carolina, Georgia, Alabama, Mississippi, Louisiana, and Arkansas. This is because cane sugar can now be bought everywhere at a low price, and is preferred to maple sugar for sweetening. In Indiana, Michigan, and Illinois the maple trees have been extensively cut for lumber, thus reducing the opportunity for tree tapping. In those States also the markets are glutted with imitations, which removes the incentive to extending the industry. In other States, as in western Maryland, West Virginia, Ohio, New York, and in New England, the maple sugar industry has held its own or been increased.

The best sap flow is secured in the cooler northern States, yet good results can be expected in most of Pennsylvania and West Virginia, in western Maryland, all of Indiana and Kentucky, eastern Tennessee, and western North Carolina. At present the largest producers of sugar maple products are Ohio, Vermont, and New York. The sugar and black maples yield the most and the best sap, although some other species of maple may be worked to advantage when neither of these is available.

The maple is a hardy and vigorous tree and readily reproduces itself, so there need be no fear of failure of sap supply. For sap production the all important consideration is for the tree to have a full and heavy crown. Yet

it should also grow under forest conditions which maintain a ground cover of litter and humus.

As a result of the study recently made definite directions for the management and improvement of existing groves, and for the establishment of new ones in suitable localities and under different conditions, have been prepared and will soon be published. Many valuable data regarding the profit in making maple sugar were also collected. From these it appears that a farmer can easily clear about \$3 an acre from a sugar grove. The expenses in this estimate are placed at a maximum; all the labor and hauling are charged in at market rates, though as a matter of fact the sugar season falls at a time when the farmer has little other employment for himself or his horses. In actual practice, for the farmer who can do most of his own work, the profit should be considerably larger. And the land thus utilized will yield little or nothing under any other use.

The old method of collecting the sap by making a diagonal cut in the tree was abandoned long ago because it injured the tree so that it could be worked for but a few years. The approved practice now is to bore a hole one inch deep and three-eighths of an inch in diameter into the sunny side of trees over 12 inches in diameter, and to make but one hole in each tree, except possibly where the trees are especially large and productive. Vast improvements have also been made in appliances for handling the sap and boiling it down to sugar and syrup.

Maple trees now furnish but a small per cent. of the commercial maple syrup and sugar. While the demand for both these commodities has constantly increased, the output from ma-

ple trees has decreased during the last twenty years. The trade has been supplied only by radically adulterating the pure goods, or by manufacturing a product entirely from foreign materials. It is conservatively estimated that seven-eighths of what is sold as maple syrup and sugar is a spurious article. Most of the fabrications are entirely harmless, but they are not the real thing. Those fortunate enough to have eaten the genuine article will always demand it, and conditions should be such that they may get it, if they are willing to pay the price.

The fault does not lie with the producers, those who tap the trees and reduce the sap to syrup and sugar, but with the middlemen who buy the sugar and mix and adulterate it most profitably for themselves. The extent of this adulteration is illustrated by the fact that while the amount of the raw product has decreased, the whole quantity has largely increased and its market price has been reduced. Of late years the price has fallen in direct relation to the decrease in the price of cane sugar.

The most common substitutes used in the adulteration of maple sugar and syrup are other sugars and glucose. Much of the so-called maple syrup on the market is nothing but a combination of sweets with a little maple molasses added to give the maple flavor. There is also a maple syrup which contains no maple at all, but the flavor is obtained by adding to the

compound an extract of hickory bark. This extensive adulteration forces the producers of pure maple syrup to compete with cheap imitations. The price of their raw product is kept down, and the forests of maple are not as profitable to their owners, as they otherwise might be.

The consumer is entitled to pure goods, and the producer is entitled to have his syrup and sugar bought and used for what it is. The remedy is in the hands of the producers, and they can effect a change for the better in two ways. They can associate themselves in State and large local companies, and, by selling direct to consumers, cut out the middlemen; and they can also put their produce on the market in the form not of sugar but of syrup, which is most in demand. The public will not object to paying a little higher price for guaranteed pure goods. The cost of making and handling syrup might be a little more than that of sugar, but the net returns would be larger, the public better served, and the maple sugar industry profitably extended. The association plan has been adopted in Vermont with excellent results. Annual meetings are held, through whose influence improved methods of production have been adopted, a central market established, and a registered trade-mark created which is a guarantee of absolute purity. In this way a trade of good proportions has been built up.

RE-CONQUEST OF NEVADA

BY

GUY ELLIOTT MITCHELL

Secretary, The National Irrigation Association

HAS Nevada always been an arid and desert region? Its geological records, as indelibly carved in sandstone and granite, showing the shore lines of ancient lakes, proclaim

that it has not, but that at one time a vast body of water, as great in area as Lake Erie, covered a portion of the State. To-day, however, the aridity of the country is unquestioned and the

350,000 acres, to part of which Uncle Sam is about to apply water, will practically double its irrigated area and its agricultural population.

Nevada's ancient inland sea is known as Lake La Hontan; it was one of the several great pre-historic lakes distributed over the Great Basin of the arid region, among them Lake Bonneville of which the Great Salt Lake was the deepest portion. Its area was nine times greater than the Great Salt, or almost as large as Lake Michigan and much deeper.

The contracted remains of Lake La Hontan, in Nevada, are found in Pyramid Lake and a number of other small enclosed lake which were the deepest portions of the ancient lake. Since these large pre-historic lakes were land-locked and did not overflow, it follows that the rainfall which fed them was much heavier than it is to-day.

Should conditions revert, many of the important points situated in the Great Basin would be hopelessly flooded, such for instance as the Mormon Temple, which would stand in 850 feet of water, while 700 miles of railroad would be submerged.

These pre-historic lakes are said to be of very recent origin—that is, recent by the geologists' count—perhaps 30,000 or 40,000 years old. Fossils have been found showing the presence of primitive man along their ancient shores and embankments, which in many instances, are as perfect in contour and as distinct as if the waters had receded only a few years since. These lakes included such arid and fear-inspiring localities of to-day as the Black Rock Desert, Skull Valley, Death Valley, and a score of other places where the bleached bones of man and animal attest to an awful lack of water.

This first irrigation work of the national government, which is to be celebrated by the turning of the water into the gigantic ditches next month, is the largest project which has been definitely outlined and approved under the

irrigation act—known as the Truckee-Carson project. When completed it will involve the expenditure of approximately \$9,000,000 and will reclaim 350,000 acres of desert land. That portion of the system now completed consists of a canal 31 miles long to take water from the Truckee River and convey it to the Carson River, where a large storage reservoir is projected. Just below this reservoir site, the waters of the two streams will be led out upon the plains by two canals, with a combined capacity of 1,900 cubic feet per second. Some 50,000 acres are to be irrigated this spring, for which 200 miles of small distributing ditches have been dug.

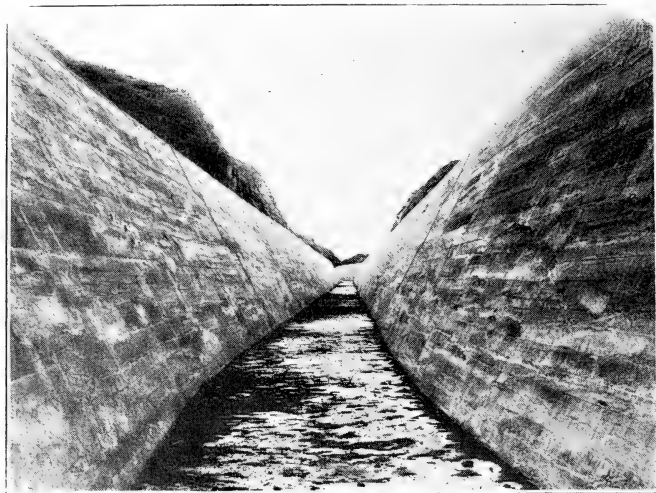
The Secretary of the Interior has set aside \$2,740,000 of the Reclamation Fund for the initial work, and by the time this has been expended about 100,000 acres will be under canals, and the settlers will be returning in annual payments the original investment. The money thus received will be used as a revolving fund for the completion of this project. The land has been divided into farm units of 80 acres, and the cost of reclamation will be \$26 per acre. Work is being commenced this spring on regulating gates at the outlet of Lake Tahoe, located in California, but whose waters will be used to reclaim the fertile Nevada soil. Future plans involve the draining of Carson Sink, 25,000 acres in extent, which overflows in years of heavy rainfall, and the reclamation of lands in the upper Truckee and Carson valleys. As these large areas are gradually brought under irrigation a greater water supply will be required and nine additional reservoirs will be constructed, with a combined storage capacity of over a million and a quarter acre-feet (an acre-foot equals one acre, one foot deep).

The soil under this project is very fertile, and deciduous fruits such as apples, pears, peaches, grapes, all the berries and vegetables produce luxuriantly. Wheat, oats, potatoes and alfalfa are the staple crops. The lands

are tributary to the Southern Pacific, the Nevada, California and Oregon, and the Virginia and Truckee Railroads, and the recent enormous activity in gold and silver mining in Nevada insures a nearby and profitable market. At the same time the supply of food products will greatly reduce the cost of living and further stimulate mining development.

The fact that a very large portion of the lands included in this project belong to the government and have been withdrawn from speculative en-

land owners, while the opportunity for settlement and increased population has never been extensive. Nevada's land history is one which can be studied with profit by those who are searching for light on the question of proper administration of the public domain. With exception of the influx of immigration due to mining excitement, the population is as a standstill and must continue to remain so until farm lands are thrown open to settlement in small tracts through government irrigation.



Cement Lined Canal, Nevada Government Irrigation Works.

try under the desert and other land laws, is a matter for congratulation. Nevada's past history has been one of land monopoly, in fact it has been said that the State was long since stolen by land robbers. In area Nevada is three times the size of Indiana, but her population is scarcely sufficient for a single small county. The popular vote of last year was but little over 12,000. The bulk of the inhabitable lands are in the hands of a few great

When the State was admitted to the Union, in place of receiving the usual donation of alternate school sections—16 and 32 in each township—it secured a flat grant from the government of two million acres of public land to be located wherever its law-makers saw fit. The State legislature passed as much as desired of this great and valuable resource into private ownership of stockmen, at as low a figure as 25 cents an acre. These lands have been

located up and down the sides of every river and stream and around every spring and water hole in the State, so that while Nevada has to-day some 60,000,000 acres of public land, there is not a quarter section of it upon which a homesteader could make a living. The land granted to the State for school purposes—disposed of by the State for a mess of pottage—controls the lands for the State.

The government's irrigation plan, when worked out, will immediately

double Nevada's population; it will provide a new life-blood of settlement and citizenship for a region of unsurpassed agriculture.

This great reclamation scheme for the rebuilding of Nevada is being carried into operation by Engineer L. H. Taylor, under the supervision of Frederick H. Newell, Chief Engineer of the Reclamation Service. It will afford the first practical example of the operations of the new national irrigation law.

PROGRESS OF THE SALT RIVER PROJECT

Work Going Forward Rapidly on
this Great Reclamation Scheme

THE town of Roosevelt, Arizona, humming as it is with the activities of its 3,000 inhabitants, is doomed. Its lease on life is only three years long. In 1908, when the engineers of the Reclamation Service shall have completed the highest dam in the world, Roosevelt will lie 172 feet below the surface of the water in the reclamation reservoir. Work has been in progress there for about a year, but men are laboring now, night and day, in three shifts of eight hours each, in order that no more than three additional years may be consumed in the task. Then Roosevelt will be no more.

Shut in by mountains as the valley of Salt River is at this point, there is no place else where the men who are constructing the dam for the Salt River reclamation project might build them a city except in the very valley that is destined to be submerged. The town or camp of Roosevelt is situated partly on the flat along Salt River and partly on the hillside above the high water mark of the reservoir. In the lower part of the camp are located the temporary power plant, the commis-

sary, the corral, the hospital, and the dwelling tents of employees of the Reclamation Service of the United States Geological Survey and of contractors working for the Government. In that portion of the camp known as "Roosevelt-on-the-Hill" are the cement mill, an office building, dining hall and kitchen, numerous tent houses, and several frame structures erected for the use of the engineering force and their families.

Three mail and passenger stage lines connect Roosevelt with the outside world. The Globe line, which is about 42 miles long, provides a daily stage service from Globe, which has Southern Pacific Railroad connections. By means of the Mesa line, passengers and mail can be brought to the dam in one day from Phoenix, which is the center of the territory. The route, which is about 60 miles long, runs through the most picturesque part of Arizona. Capitalists are even now considering the advisability of putting on an automobile line from Phoenix to the dam, of constructing a trolley line between the two points, and of erecting a tourist hotel in the

mountains not far from the dam site. A third stage line, also in daily operation, is the one between Payson and Roosevelt. It is about 63 miles long.

The contract for the Roosevelt dam has been recently given to J. M. O'Rourke & Co., of Galveston, Texas, and the most serious work of the project will soon be under way. During the past year, however, a vast deal of important preliminary work has been accomplished by the inhabitants of Roosevelt. A temporary power plant,

between Phoenix and Roosevelt. A road to the timber in the Sierra Ancha Mountains has also opened up a new country. Altogether, it has been necessary to construct about 80 miles of road.

Much of this work has been done under most unfavorable circumstances. From February until the end of March there was almost continuous rain and snow. Never in the history of Arizona has snow been deeper than it was last winter, and the chances for high water during the entire summer



Salt River Canyon, Arizona, Looking Downstream from Point About Half Mile Above Dam Site.

a cement mill, an ice plant, a lighting plant, and a saw mill have all been completed. The power canal, which will furnish water power for the generation of electricity to operate all the work, will be done in a few months. A telephone line connecting the head-works of the power canal, about 18 miles above Roosevelt, with the Arizona dam, which is about 30 miles from Phoenix, has also been installed. In the face of great engineering difficulties, a wagon road has been built

are, unfortunately, almost certain. During the greater part of March the road to Globe was impassable and the Gila Valley, Globe, and Northern Railway was out of commission. The Southern Pacific bridge across the Gila at Maricopa was rebuilt half a dozen times during that month. It is apparent therefore that materials for construction work were not hauled into camp very rapidly during part of the past winter.

It might be said of the unwelcome

rains, however that they rather improved the power canal by consolidating the banks. The grading work for this canal was done by Sherer & Co., of Los Angeles, and the tunnel work by John Tuttle, of San Francisco. Water will be diverted from the river to the power canal about a quarter of a mile below the confluence of Pinal Creek and Salt River. The canal is 19 miles long and its construction has involved the excavation of about 600,000 cubic yards of material

The cement mill, which has been ready to run since the middle of February, is now in operation. The fuel used in burning cement in the kilns is crude petroleum from the California oil fields. The beginning of manufacturing cement was delayed through the fact that only one tank of oil reached the mill during March. That had been two weeks on the road, weighed about 2,500 pounds and required six horses to haul it. The other oil tank got stuck in the mud



View in Sierra Ancha, Salt River Watershed.

and the driving of nearly 9,000 feet of tunnel.

Until power can be obtained from the power canal, a temporary steam plant has been built for the purpose of furnishing power to the machine and wood shops and for running the cement mill. It has also run the hoist for the material, which has to be elevated 300 feet to the cement mill, and has furnished light and power for drilling operations in the tunnels at the dam.

between Globe and Roosevelt and had to be abandoned.

About 400 tons of machinery and 60 tons of structural iron have gone into the construction of the cement plant. The ball mills weigh about 12 tons each; the tube mills, when ready for grinding, weigh about 20 tons, the crusher 15 tons, and the rotary kilns for murning the cement are 70 feet long and weigh 40 tone each. Attached to the mill is a well-equipped laboratory under the charge of two

chemists, who will devote all their time to standardizing the cement materials and testing the products of the mill. It is expected that about 200,000 barrels of cement will be required in the construction of the Roosevelt dam, the power canal, and the various Tonto improvements. The cement used in the preliminary work costs \$5.35 a barrel delivered at the point where it was used. Bids were later received for furnishing cement at \$4.81 a barrel. It will cost the Government \$1.60 a barrel to make the cement on the ground. If the cost of the plant, \$120,000, be added to the cost of the 200,000 barrels of cement required, the total cost of the Government cement will still be only \$2.20 a barrel. This means a saving of \$2.61 a barrel, or a saving of \$522,-

000 on the entire work. After the dam and canal have been completed, the cement plant will still be capable of further use, and considerable salvage may doubtless be realized.

Two new gaging stations were established on Little Colorado River and its tributaries during March. A party has been surveying a possible power canal on Verde River, the power to be used to supplement that obtained from the dam when it is desirable to store water in the reservoir. It is proposed to do considerable reconnaissance work in the northern end of the Territory, at the headwaters of San Pedro River and on San Carlos and San Francisco Rivers.

Mr. Louis C. Hill is the supervising engineer in charge of the work on the Salt River project.

RECLAIMING THE ARID LANDS OF THE NORTHWEST

BY

THOMAS COOPER

Land Commissioner, Northern Pacific Railway.

NO single feature of the development of the Great Northwest—the states of North Dakota, Montana, Washington and Oregon—is more significant of future greatness than the work done during the last decade in bringing the semi-arid land under cultivation and in developing methods by which great areas are made immensely productive.

Irrigated lands produce never-failing crops. The land and the water, primary elements in crop production, are known quantities and can be depended upon. Adjacent to the principal areas of the Northwest in which irrigation development is now in progress are splendid home markets waiting to take all that the land will produce.

The land to be brought under cultiva-

tion through the work of the United States Reclamation Service, the organization through which the Federal Government is carrying out the largest scheme of irrigation development and irrigating works yet attempted, will be thrown open to settlement as fast as the water is supplied, under terms which, from the standpoint of the settler, will be very reasonable.

Land irrigated by the United States government will be subject to entry under the Homestead act, as modified by the Reclamation act. The cost of irrigation works and the expense of furnishing water to a given district will be apportioned pro rata to the acreage benefited and the cost per acre, thus obtained, is what the settler pays for the land and the water rights, in ten annual payments without interest.

The cost per acre varies with the cost of the project, the term used by the government engineers to designate irrigations plans and work in a given district. On projects so far undertaken the cost runs from \$15 to \$30 an acre. The Reclamation Service carefully considers the character of the land, its proximity to markets and transportation facilities before undertaking any improvements, in order to make sure that there will be left an ample margin of value above the cost of the work when completed.

The purchase money received by the government goes back again into the reclamation fund to be used over and over again in building other canals and in supplying water to new districts.

The irrigation projects along the lines of the Northern Pacific Railway on which work will probably be inaugurated during the present year by the government Reclamation Service are the Lower Yellowstone Canal, which will irrigate 40,000 acres in Montana and 20,000 acres in North Dakota, and several others of importance. The Yellowstone canal will take water from the Yellowstone River at a point about thirteen miles below Glendive, Mont. An association of the land owners under the canal has been formed as required by the Reclamation Service and is called the Lower Yellowstone Water Users' Association. It is expected that all of the necessary preliminary work will be completed within sixty days, after which contracts for the construction of the canal will be awarded.

On the Crow Reservation several canals are contemplated by the Reclamation Service, one of which, known as the Huntley Project, will irrigate 30,000 acres and will be put under contract within a few weeks, it is expected. The lands irrigated by this canal are in the vicinity of Huntley Station, on the line of the Northern Pacific, a short distance east of Billings, Mont. It is expected that at least two other good irrigation projects will be developed on the Crow

Reservation, as surveys already made indicate that they are feasible and that their cost will be low.

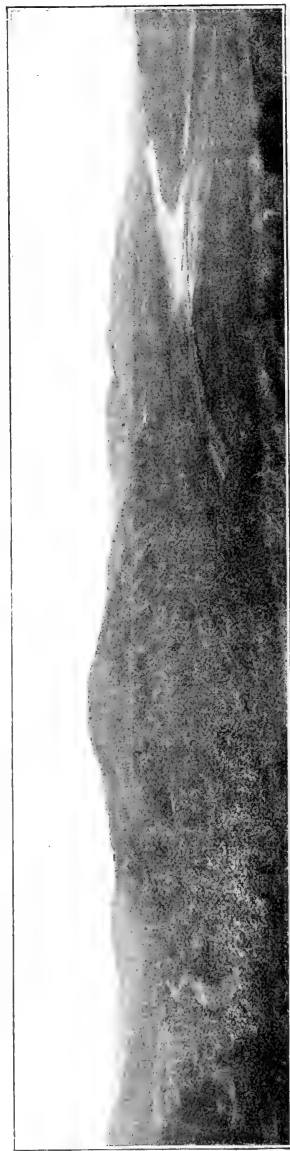
In Washington the Reclamation Service is endeavoring to remove the obstacle in the way of the Washtucna Coulee Project, which is to irrigate 100,000 acres of land in the vicinity of Pasco. This is one of the largest projects so far undertaken by the government and involves the construction of a large dam across the mouth of Washtucna Coulee, for the purpose of creating a reservoir in which to store the waters of the Palouse River. The principle obstacle lies in the fact that the coulee is now occupied by the tracks of the Oregon Railway & Navigation Company, a branch line connecting with the Northern Pacific at Cannell. This branch must be moved to higher land if the government engineers go forward with their plans. It is understood that good progress is being made in the negotiations between the Reclamation Service and the Oregon Railway & Navigation Company for the removal of the branch. In all likelihood the work of constructing this irrigation project will be commenced this year.

Surveys have been made for a large number of other projects along the lines of the Northern Pacific Railway, some of which have been found impracticable under present conditions and others possible. Among the latter are two projects for pumping from the Missouri River in North Dakota, one in the vicinity of Fort Buford and the other in the vicinity of Bismark. The engineers are working out the details of these two projects.

In addition to the projects of the Reclamation Service there are a number of irrigation canals under construction by private capital at different Northern Pacific points. At Forsyth, Mont., the canal of the Rosebud Land & Improvement Company, irrigating 12,000 acres, will be completed and in operation this year. The Billings Land & Irrigation Company will also complete a large canal, irrigating 40,-



Green Lake Reservoir Site, Washington.



Junction of Methow and Columbia Rivers, Washington.

ooo acres, near Billings, Mont. This company is now placing its lands upon the market. The construction of a large sugar beet factory is now assured and a large irrigated area has been proven to be splendidly adapted to the growing of sugar beets.

On the table lands immediately east of Spokane several canals have been and are now being constructed, utilizing the numerous lakes in that district for storage purposes. Under these

States Department of Agriculture and the State Experiment Station of Montana for conducting a number of experiments in dry-land farming this year in eastern Montana. These experiments will be started within a short time, and it is confidently expected that the results will show that millions of acres of Montana lands heretofore assumed to be valuable for grazing only, are adapted to agriculture. This is predicated upon the fact



Grand Canyon, North Platte River, Looking Downstream at Site of Proposed Dam, Pathfinder Reservoir, Wyoming.

canals irrigated lands can be purchased at very reasonable terms.

There is still a large area of irrigated land under the constructed canals in the famous Yakima Valley in Washington. An extension of the Sunnyside canal, now one of the largest in the United States, is contemplated this year. This will water 200,000 acres additional.

The Northern Pacific Railway has made arrangements with the United

that the minimum rainfall in eastern Montana is about fourteen inches, that the soil is generally good, and that this method of farming is being profitably conducted in eastern Washington, California, western Kansas, Nebraska and Colorado in districts where the annual rainfall is from nine to ten inches. It is also known that in that portion of North Dakota west of the Missouri River where the rainfall is from fourteen to sixteen inches the

farmers are doing well and although last year was unusually dry, there was a very large increase in the products shipped from the different stations in North Dakota and west of the Missouri. This country is being rapidly settled up by a good class of settlers attracted by the large areas of unoccupied government lands and the low prices at which lands are being sold by the land companies operating there.

It is a constant source of surprise to all who are familiar with the conditions that the settlement of northern Minnesota does not proceed more rapidly. There are millions of acres of excellent lands in northern Minnesota where the timber has been cut off which are waiting for settlers and which are obtainable at very low

prices. There appears to have been no systematic effort towards securing immigration in Minnesota, and the result is that settlers have gone and are going farther north into Canada, trying to make homes on lands not nearly as well adapted to their purposes as those they are passing by in Minnesota. An excellent move to cure this condition of affairs would be the establishment of a State Immigration Bureau. The ownership of northern Minnesota lands is so diverse that it would be difficult if not impossible to secure unity of action by the land owners, and as every settler adds to the wealth of the State it is entirely proper that the work of securing them should be borne by the State as a whole.

IRRIGATION IN TEXAS

TEXAS has at present about 300,000 acres of irrigated land, of which 75,000 acres are planted in ordinary crops and 225,000 acres in rice. For years stock raising has been the only industry of the arid and semi-arid portions of the State, but the homesteaders of the last decade have cut up the great ranches into small farms and created a demand for water with which to make their crops grow. Cotton fields are pushing their way now into western Texas. The rice fields are confined for the most part to the coast country, but the belt of irrigated land where general farm products flourish extends from El Paso to the Guadalupe, and from the Rio Grande to the Red River on the north.

Irrigation is, however, no new thing in Texas. It must not be forgotten that the Lone Star State is a commonwealth with the romantic history that befits a border State. Long before it became a republic the Indians were irrigating land along the Rio Grande. Afterward the Franciscan friars who came with the early Span-

ish conquerors carried on irrigation for the cultivation of their fields in the southwestern part of what is now the State of Texas. In the northern and central parts of the State irrigation has been carried on to a limited extent for many years.

For some time irrigation development in the Pecos and Rio Grande valleys has been retarded by the lack of water supply which the heavy demand on those rivers in New Mexico and Colorado occasions. There are many places, however, in the trans-Pecos country, where impounding dams might be constructed across narrow canyons or gorges to form reservoirs for the storage of flood waters.

In the Pecos Valley and along the Concho in Tom Green County water for irrigation is taken from flowing streams. Big springs supply irrigation systems in the trans-Pecos country and along the San Felipe and San Antonio rivers. Some of the best results in the State are produced by irrigation from artesian wells near San Antonio and in the Rio Grande country from Corpus Christi to Browns-

ville. About 200 good artesian wells have been sunk in this neighborhood in the last five years. Water from artesian wells is in high repute in this local for irrigation purposes.

Gravity systems, pumping plants, and artesian wells are all utilized by farmers who live in the valleys of the Colorado and San Antonio rivers, the most important of the Gulf streams. Agriculturists realize more fully each year the advantage to be derived in years of deficient rainfall from a system of irrigation.

Many of the truck farms in southern Texas are supplied from surface wells, the water of which is pumped into small reservoirs of from 3,000 to 5,000 cubic feet capacity. Over 500 such wells are in use at present. It is estimated that 75 per cent. of the irrigation in Texas during 1904 was accomplished by means of pumping plants, and 70 per cent of the area supplied by pumps was cultivated in rice.

The use of impounding reservoirs has not entered very largely into the irrigation economy of the State, but as the demand for water grows, attention is turned to this source of supply, and the storage reservoir at Wichita Falls will soon be duplicated at scores of other points in Texas. San Saba Valley, above the town of San Saba, is one of the most fertile sections in

the world, and definite plans have been made for the construction of a dam across the canyon about 18 miles above the town to form an immense storage reservoir from which water can be conducted to the valley below. This canyon is about 50 miles in length, and by means of a series of dams and canals it is believed that about 40,000 acres above and below the town of San Saba can be brought under ditch. Irrigators along this stream from the head of the canyon to the springs already take practically the entire normal flow of the stream, making any system in the lower San Saba dependent largely on storage water.

The Llano River in Kimble County supports at present many small irrigation plants, but large systems could be constructed in the vicinity of Junction City to utilize the flow of the South Llano.

The headwaters of the Nueces and Frio are torrential in character and impounding reservoirs can be constructed in the canyons northwest of Uvalde, from which the water could be carried to the valleys above and below the Southern Pacific Railroad. Devils River also offers opportunities for impounding waters and carries a substantial and reliable discharge. It would water lands in the vicinity of Del Rio.

FOREST LEGISLATION IN THE NORTHWEST

FOREST legislation in Washington for the session of 1905 was a result of the efforts of an association of timbermen formed for the purpose of securing some legislation favorable to the timber industry relating principally to right-of-ways. A forest fire bill was introduced during the closing days of the session, and passed practically as introduced, with the exception of the cutting down of the appropriation.

Like many other new states in the West, Washington finds that its requirements in the way of appropriations exceed, very often, its ability to raise the necessary money; and as a result at the close of a session there are always a large number of interests which are unable to get proper consideration, owing to the state of the treasury.

Two years ago, or during the session of 1903, "a forest fire law" was

passed, which provided that county commissioners should be *ex-officio* fire wardens; and provided for a closed season, to be designated by the county commissioners, during which slashing fires could be kindled only permits issued by them. No special fund was provided for the work, excepting that the land commissioner was authorized to prepare "fire notices" and distribute them through his office. Expenditure on this account, for the two years, was \$40. The law was better than nothing at all and succeeded in keeping down fires to a considerable extent; but in some counties the county commissioners did not see fit to do anything in the matter, and hence the law was a "dead letter." Better results were secured during the first year, while the memory of the great fire of 1902 was fresh in the minds of everyone. In 1904, only a few of the counties did anything toward keeping down forest fires.

The law passed in the session of 1905, was introduced as Senate Bill No. 246, by Senator Rands. The bill provides for the appointment, by the governor, of a "Board of Forest Commissioners," consisting of the State Land Commissioner and four electors. The term of office shall be for four years from the date of appointment. The board of forest commissioners shall supervise all matters of State forest protection; and have full power to appoint all employes of the forest service, including fire wardens and deputy fire wardens; and shall make all rules and regulations, for the prevention, control and suppression of forest fires. They shall gather information regarding the timberland owned by the State, through the investigation of the fire officials; report upon damage done by forest fires and illegal cutting and trespassing upon State timberlands.

The fire warden and forester shall receive a salary of \$1,500 per year; and shall act as secretary of the Board of Forest Commissioners. He shall have direct charge and supervision of

the forest fire service of the State, subject to the rules of the board of forest commissioners. His duties include the posting of notices, the appointment of deputy fire wardens, subject to confirmation by the Forest Commission; auditing of all bills for salary and expenses incurred in suppression of fires, presenting a statement thereof to each county for the payment of their proportion of the expense. And a considerable amount of scientific work covered by the following provisions:

"It shall be his duty to institute inquiry into the extent, kind, value and condition of the timberlands of the State. The amount, in acres, and the kind of timber that is cut and removed each year. The extent to which timberland is being destroyed by fire. And also examine into the protection, quantity, and quality of timber. And he shall make a written report to the State Board of Forest Commissioners upon all such facts, together with detailed information as to the work of the forest fire service of the State."

In each of the timbered counties of the State there shall be appointed during the period, from June 1 to October 1, a deputy fire warden, who shall receive a compensation of \$4 per day. Deputy fire wardens shall represent the authority of the Commission, and the State fire warden in their respective districts and shall have authority to employ or impress help for the suppression or control of forest fire. They shall be under the direction of the State fire warden, who shall have power to mass them at any point requiring especial protection.

A fine of \$25 for refusing to render assistance, is provided for, when called upon by a forest ranger, and any one needlessly destroying a warning notice shall be liable to a fine not exceeding \$100 or to imprisonment not exceeding thirty days.

Provision is made for the appointment of forest rangers and timber cruisers, in the employ of private corporations and individuals, as forest rangers; but without any compensa-

tion for their services. Such officers appointed under this provision shall have power to make arrests, without warrants, of any person violating the act.

The closed season, for burning or slashing, wood and brush land, is fixed from June 1 to October 1 of every year. And in order to make a burning it is necessary to obtain first a permit in writing from a deputy warden of that county. Any person burning without this permission shall be deemed guilty of a misdemeanor and fined in any sum not exceeding \$100, or be imprisoned not exceeding thirty days. If in the judgment of the deputy fire warden it is deemed necessary he can designate a deputy who shall have full charge of all burning under any permit, with full power of revocation in case he considers the burning dangerous. The penalty provided for the wilful or negligent setting or starting of fires is not over \$500 for any negligent fire; for a malicious fire the maximum fine is \$1,000 or imprisonment for one month to one year, or both imprisonment and fine; and also shall be liable for all damages in civil action.

Any person, during the closed season, who shall leave a fire dangerously near or on any forest land, or cause any fire to be set, shall be liable to a fine not exceeding from \$10 to \$100 or imprisonment not exceeding two months.

It is provided that all locomotives, logging or farm engines or boilers shall be equipped with spark arresters for the months from June to October inclusive; and a fine of from \$10 to \$50 per day is provided for in case of neglect to operate said locomotives or engines as provided. A section is included taken from the California law, making country prosecuting attorneys liable to prosecution, who do not diligently prosecute alleged cases of violation under this law.

The original bill called for an appropriation of \$25,000; this was reduced in the Senate to \$7,500, with \$2,500

in another fund, and with a provision that the amount expended in any country for fire suppression or protection, shall be payable, one-third by the country in which it is located and two-thirds by the state. This will make a total of about \$6,500 annually for fire protection in the State of Washington. A very inadequate sum when the immensity of the forestry resources are considered. The timbermen of the state are taking steps toward supplementing this amount. In this way it is hoped to raise at least \$15,000 per year for the fire protection work.

The Governor has already appointed as Forest Commissioners, Hon. Joseph Irving, of Snoqualmie, and Frank H. Lamb, of Hoquiam. The other appointments will be announced later; the law not taking effect until June, 1905. Washington has made the best start of any state of the Pacific northwest in fire protection, but Oregon and Idaho are closely following in its steps.

OREGON.

In its session of 1903, the Oregon legislature passed, with only six dissenting votes, a Forest Fire Law, modeled largely upon the old Washington law; and which made the Superior Judge, of each county, a "Fire Warden." This was vetoed by Governor Chamberlain on the ground that the state, since it had parted title to all its timber or state lands, was not interested in the protection of the property of a private corporation or individual.

In his message to the legislature of 1905, the Governor again reiterated his position and stated that he would veto any measure appropriating money for the protection of private property; therefore, a law was devised, to obviate these objections, which was passed by the Legislature in its closing days. The county court of each county is authorized and empowered to appoint fire rangers in their respective counties; said fire rangers to be paid by the timber owners so apply-

ing for their appointment, and in no case to be paid by the county clerk, and shall hold office for the period of one year from the date of their appointment, unless sooner removed. The county judge shall have all the powers and duties of the county court during time said court is not in session. And the county clerk shall keep a record of all fire rangers qualified within his jurisdiction. It shall be his further duty to issue written or printed permits, during the permit season, to any person wanting to set out fires. Such permits to be issued from June 1, to August 1; and shall fix the time of setting out of fire at a day named; and not more than ten days from the date of the permit. The provision for setting fires at a certain time of day was lost in the committee. Upon the granting of a permit, the clerk shall notify a fire ranger in the vicinity of the proposed fire, who shall watch the burning of said fire. The fire ranger shall have complete power and authority to arrest, without warrant, persons who violate the provisions of the act. And from June 1 to October 1, of each year, it shall be unlawful for any person to operate a spark emitting locomotive, logging, farm or stationary engine located in a timber district, without a reasonably safe spark arrester. The law also provides fines, for the setting out either negligently or maliciously of forest fires, similar to the Washington law.

The Oregon act attempts to accomplish, without expense to the state, the work that is as much a duty of the state, as is the duty of a municipality to protect the private property therein from destruction by fire.

IDAHO.

In Idaho a forest fire bill was introduced, by Senator Page, almost identical with the Washington Fire Law of 1903. But this although passed in the Senate did not carry in the House. And the result was a compromise upon House Bill No. 131, which united several acts relating to pub-

lic lands. The portion of this act relating to forest protection, provides that all camping parties, either for business or pleasure, must take out a permit to camp. And grants to probate judges, justices of the peace, game wardens and deputy wardens of the State, the power of issuing these permits upon the payment of fifty cents as a fee. It further provides for the printing and distributing by the State Auditor, of books containing these licenses. The State Land Commissioner, his assistants, land appraisers and collectors, game wardens and *ex officio* deputies and all police officers of the State are charged with the enforcement of the forest protection as relates to forest fires; and shall have power to arrest violators of the provision of the act and deliver them to a constable.

Section 13, Provides that the right-of-way of any railroad in the state shall be kept clear of any inflammatory material, and every locomotive used in a forest area, shall be equipped with a sufficient spark arrester.

For the purpose of carrying out the provisions of the act the State Board of Land Commissioners are authorized to employ, not exceeding six persons, at any one time, at a sum not exceeding \$5 per day, and who shall be empowered to arrest any violator of the provisions of the act. Penalties are provided for the negligent or malicious setting of fires and allowing them to spread. Prosecuting attorneys are directed to prosecute in the name of the State all cases arising under the act.

So far as Washington is concerned it is felt that the forest work is under test and it is the desire of all connected with the service that good results may be accomplished.

There has just been inaugurated in Seattle, a State Forestry Association, which intends to take up the scientific part of the work and hopes to provide for the publication of the results gathered by the Forest Commission and the fire service.

PLANTING RED PINE

THE red, or Norway pine (*Pinus resinosa*), as it is sometimes called was first described in 1755 by DuRoi. It usually attains an average height of 70 to 90 feet and a diameter three feet from the ground of 15 to 24 inches. The stem is straight, scarcely tapering, covered by a reddish-brown bark, which in old trees readily separates on the surface into thin, flat, loose scales, giving the trunk a conspicuous appearance. The branches are coarse, extending horizontally or slightly declined, forming a broad based or conical head. The leaves in twos protruding from close, elongated, persistent, conspicuous sheaths, are slender, flexible, dark green, and lustrous, 5 to 6 inches long. The cones are borne near the extremity of the shoots at right angles to the stem, maturing the second year, and 1 to 3 inches long; in shape ovate to oblong conical; when opened broadly oval or roundish; scales not hooked or pointed, thickened at the apex.

RANGE.

The natural range of the red pine is from Nova Scotia and New Brunswick westward to Manitoba, and Southward to the Great Lake region. It extends somewhat further north than the white pine, being found on the height of land well north of Lake Winnipeg, but not so far north as the jack pine. In the east it extends through northern New England and New York, southward to eastern Massachusetts and the mountains of Pennsylvania. It does not, however, extend as far south as the white pine. It is found most abundantly and grows to its largest size in the northern portion of the Lake States, often forming pure forests many acres in extent.

One peculiarity of this tree is that it prefers to grow in groves unmixed with other trees, although some white pines are occasionally mixed with the red. It is also found frequently grow-

ing in groves of mature jack pine, having come in under its partial shade, and when once beyond the critical period it rivals the jack pine and may finally overtop it.

The red pine is adapted for planting in the natural pine regions of New England, the St. Lawrence Valley, Michigan, Wisconsin, and Minnesota.

SILVICULTURAL QUALITIES.

The red pine type is found on loamy, sandy plains and on the ridges of sandy and gravelly loam. In regions where the hardwood, white pine, red pine and the jack pine types are present they become more xerophytic in character in the order named. It is frequently found, however, growing to the very edge of the swamps where their root system can reach the water level. The red pine is a light-demanding species, bearing less shade than white pine but more than jack pine. The seedlings in order to grow must have plenty of light. The young stand in the natural forest, as a rule, forms rather heavy shade, but the mature forest is decidedly open. In fully stocked stands under 100 years old there is not enough light admitted to permit a dense undergrowth, but soon after 115 years brush growth appears and gradually extends throughout the stand. This intolerance of shade is a disadvantage in competing with other species, but as soon as the tree gets started its rapid growth enables it to keep its crown free to the light. The rapidity of growth of red pine, in its earlier stage of development, is an important feature. The rate of growth in height will vary, for seedlings, according to the amount of light they receive. Under partial shade the growth is extremely slow. If the seedlings are in dense clumps they will grow faster than when scattered. During the first fifteen years after natural seeding on sandy soil, the red pine grew .97 feet per year, while the jack

pine grew 1.32 feet. On the other hand, the individual red pine has a faster height and diameter growth than white pine. The following results were shown by measurements taken in New England on plantations:

Species	No. of Trees	Age	Ave'ge Height	Ave'ge Diam'r
		Years	ft.	inches
White pine	40,578	30	26.6	3.73
Red pine.....	4,548	30	35.4	5.88
White pine.....	1,758	27	*43.5	5.18
Red pine.....	19	27	*48.0	6.60

*Better growth due to richer soil.

It may be stated that during the first 50 years the jack pine grows fastest, the red pine second, and the white pine last. White and red pine live to about equal age, 280 to 310 years, while the jack pine rarely exceeds 90 years of age.

The following figures on the relative yield of red and white pine were secured in northern Minnesota:

Species	Age	Ave'ge Height	Ave'ge Diam'r	No. of Trees	Vol'me
	Years	ft	inches		bd. ft.
Red pine....	119	93	13.3	285	49,065
White pine..	120	87	15.0	165	3,465
Difference in favor of Red pine..	1	1	2	120	14,415

On the whole, the white pine is no match for the red pine as far as growth is concerned.

The red pine may be said to have no serious enemies, it is peculiarly free from the attacks of fungi, and resists fire to a marked degree. When young, however, it is sometimes injured by a white grub which feeds on the tender roots. There is apparently no climate too cold either for the young seedlings or for the mature trees.

ECONOMIC USES.

The red pine is usually cut into dimension stuff and sells for 15 to 20 per cent. less in the open market than does the virgin white pine. It is

stronger than white pine, is hard, and takes a high polish. In Canada the timber is put to a greater variety of uses and is of more importance than in the United States, forming one of their chief export timbers. The quality of the timber may be graded between the longleaf and the western yellow pine.

METHODS OF PROPAGATION.

The red pine as a rule is propagated from seed. The seeds, produced in comparatively scanty crops, are shed with the ripening of the cones. They fall the same year that they mature and are followed by the cones which are not persistent. There seems to be some question as to just the length of time between seed crops. However, the most authentic reports state that the seed is borne at intervals of 2 to 4 years. The seed is difficult to obtain, both on account of the low production and the ravages of squirrels. Squirrels are especially destructive of the seeds. The cones are free from resinous sap and are not armed with sharp hooks or points. The trees begin bearing seed at a much later age than the jack pine, producing seed somewhat larger than jack but smaller than white pine.

The red pine cannot compete with the jack pine in naturally reforestation burned-over areas. Many of the jack pine cones do not open ordinarily until the tree is scorched or killed by fire. A crop of cones is produced every year on the jack pine, and a large surplus is thus provided against this contingency. The seeds, shed from the open cones in the ashes of a fire, have the first and best chance for soil space, while the red pine, although it may be abundant in the vicinity, often shows not a single seedling. One pound of red pine seed contains about 40,000 seeds, of which about 80 per cent. will germinate under favorable circumstances. The amount of seed to sow under average conditions is given below:

Manner of Sowing.	Ounces per		Average number of seedlings per			
	Running Foot	Square Foot	Running Foot		Square Foot	
			First Year	Second Year	First Year	Second Year
In drills.....	1-8-1-28		16-22	8-10		
Broadcast		1-4-1-7			80-20	35-45

The young seedlings at once produce a strong tap root. But the wind-firm character of healthy, mature red pine is not due to an especially strong taproot, but rather to a number of stout laterals. A thrifty, forest-grown tree suddenly isolated will often bend or break off rather than pull up by the roots; yet even a small crown at the top of a long stem will exert a powerful overturning force during a wind storm.

PLANTING.

The seeds should be sown early in the spring in a well prepared seed-bed, after the manner of white pine. The seedlings, however, do not demand the degree of shade which is essential to the growth of the white pine. Robert Douglas' Sons state that there is less danger from damping off of the seedlings than with other pines. The great risk usually surrounding the planting of seed directly on the final site of the mature tree makes it advisable to raise the seedlings in the nursery beds. The best stock to plant is seedlings 2 years old, 1-year transplants. On poor soil it is believed that the best results may be secured by planting red pine 5 feet apart each way; on richer soil it is best to space them wider. The greater cheapness of wide planting it, of course, a consideration if the desired results may be as amply attained. For forest plantations it is best planted pure, but might be profitably planted alternating with sugar maple.

The red pine has been more extensively planted in landscape work than in forest plantations. Where picturesque and natural landscapes are wanted there is no eastern pine that can

take its place; it is the sturdiest, boldest eastern conifer.

CULTIVATION AND CARE.

When planted on cut-over lands, care should be taken that it is not choked out by the more rapid-growing species, such as jack pine, poplar, and birch. It needs no cultivation. The only protection necessary is from fire and grazing.

EXAMPLES.

In comparison with other conifers, such as the white pine, jack pine, larch, and spruce, the red pine has been very sparingly planted in forest plantations; but has doubtless been more used in landscape work than any one of the above-named species.

Mr. Isaac Adams, of Moultonboro, N. H., planted the red pine in mixture with the white pine. He found that the red pine overtopped the white pine, showing an average growth of 34.9 feet, while the white pine showed 27.5 feet.

The red pine was planted in the spring of 1891, in Holt county, Nebraska, alternating in furrows with jack pine, Scotch, Austrian, and western yellow pine. The seedlings were 8 inches high when planted. The number of red pine planted was 315; the number living October 15, 1891, was 54, or 14.4 per cent. of those planted. These seedlings were all in good condition.

By accident some red pine seed found its way to the seedbeds of the Dismal River Reserve, in Nebraska, with the jack pine seed that was planted in the spring of 1903. The stray plants were not noticed until the spring

of 1904. All the jack pine seedlings were winter-killed, while some 40 to 50 plants of red pine came through the winter without injury, and during the summer of 1904 made a growth ranging from 6 to 14 inches in height at

the close of the season. From this example, the vigor of these plants would indicate that the red pine may be a good tree for planting on the sand hills of Nebraska and the adjacent regions.

RELATION OF THE LAW TO UNDERGROUND WATERS

A REPORT of great practical value called "Reclamation of the Law to Underground Waters," by Mr. Douglas Wilson Johnson, has just been published by the United States Geological Survey. It is the first comprehensive paper prepared in this country on the relation of the law to underground waters, and was compiled to meet a considerable demand for information on this subject. It is especially pertinent at this time, when active efforts are being made in several States to enact laws governing the use of underground waters which shall take account of the recent advances in the science of hydrology and the present knowledge of the occurrence and movements of such waters. The report is in no sense, however, a legal treatise, but rather the result of an endeavor to collect and arrange such legal decisions as will serve to show the relation of the law to problems which are essentially geological in character.

Mr. Johnson divides his discussion into two parts. In the first part he assembles the common-law rules concerning underground waters; in the second he rehearses the legislative acts affecting underground waters. He divides underground waters into two classes, those flowing in defined and known channels, and those passing through the ground below the surface, either without definite channels or in courses which are known, and he arranges all the laws relating

to underground waters as above.

This report brings into striking relief the fact that there is a great lack of agreement among authorities on questions pertaining to underground waters. This is because there is so much that is uncertain and indefinite in the behavior of waters hidden beneath the surface. A second and very important reason for the unsatisfactory condition of the law relating to underground waters is found in the fact that the state of our knowledge regarding such waters is now, thanks to the progress of geological science, in advance of the general ruling of the courts on some of the questions involved. Where a decision is controlled by opinions rendered in former cases, and not made with due regard to the present knowledge respecting subterranean conditions, it does not seem that a just settlement of the controversy can be reached.

There probably must always be cases in which the subterranean conditions are indefinite or unknown, but the number of such cases will decrease with advance in geologic knowledge. The lack of agreement among legal authorities on many of the questions at issue is rather more fortunate than unfortunate in one respect at least, since it bears witness to the uncertain position of the law on the points involved and opens the way more readily for new knowledge concerning the problems, and a wiser interpretation of the law.

DEPARTMENT OF THE INTERIOR, WASHINGTON, D. C., April 27, 1905. United States Geological Survey, Reclamation Service. Sealed proposals will be received at the office of the Supervising Engineer, United States Reclamation Service, Chamber of Commerce Building, Denver, Colo., until 2 o'clock, p. m., Thursday, June 15, 1905, and thereafter opened, for the construction of the Pathfinder dam and auxiliary works, at a point about 50 miles southwest of Casper, Wyo., to impound the flow of North Platte River. Plans, specifications and forms of proposal may be obtained by application to the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., or to the Supervising Engineer of the Reclamation Service, at Denver, Colo. Each bid must be accompanied by a certified check for \$5,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of \$50,000 for the faithful performance of the work. Each bid must also be accompanied by the guarantee of responsible sureties to furnish bond as required, if bid be accepted. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the service may require. Bidders are invited to be present when bids are opened. Proposals must be marked "Proposals for Pathfinder dam, Wyoming." E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C. April 29, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Hazen, Nevada, until 2 o'clock p. m., June 15, and thereafter opened, for the construction of outlet and controlling works and bridge at Lake Tahoe, Tahoe City, California, involving about 90,000 cubic yards of earthwork, 500 cubic yards of concrete, etc. Plans specifications and forms of proposal may be inspected at the offices of the Reclamation Service in Washington D. C., and Hazen, Nevada. Each bid must be accompanied by a certified check for \$500, payable to the order of the Secretary of the Interior, as a guarantee that the bidder will, if successful, promptly execute a satisfactory contract, and furnish bond in the sum of \$5,000 for the faithful performance of the work. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the service may require. Proposals must be marked "Proposals for Lake Tahoe outlet works, Truckee-Carson project." E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., April 29, 1905. Sealed proposals will be received at the office of the Engineer, U. S. Reclamation Service, Billings, Mont., until 2 o'clock p. m., June 28, 1905, and thereafter opened, for the construction of about 30 miles of canal, involving about 700,000 cubic yards of earthwork, some rock work and three tunnels, the same being a portion of a system for the diversion of about 400 cubic feet of water per second from the Yellowstone River at a point about ten miles east of Billings, and its conveyance to irrigable lands along the south side of said river. Specifications, forms of proposal, and plans may be obtained at the office of the Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from R. S. Stockton, Engineer, Billings, Mont. Each bid must be accompanied by a certified check for \$1,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond as required. It must also be accompanied by the guarantee of responsible sureties to furnish bond as required, if the bid be accepted. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the service may require. Bidders are invited to be present. Proposals must be marked "Proposals for the construction of canal, Huntley project, Montana." E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., April 27, 1905. Sealed proposals will be received until 2 o'clock p. m., June 1, 1905, and thereafter opened, at the office of the Engineer, U. S. Reclamation Service, Glendive, Mont., for installing, in connection with the Fort Buford reclamation project, a telephone system having four telephone stations and about 70 miles of pole line, beginning opposite Glendive, Mont., on the west side of the Yellowstone River, extending northward down the Yellowstone Valley, generally following the county road and ending at the junction of the Yellowstone and Missouri Rivers at a point nearly opposite Buford, N. Dak., on the Great Northern Railroad. Specifications, form of proposal and particulars may be obtained by applying to the Chief Engineer of the Reclamation Service, Washington, D. C., or to F. E. Weymouth, Engineer, Glendive, Mont. Each bid must be accompanied by a certified check for \$1,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 20 per cent of the contract price for the faithful performance of the work. Each bid must also be accompanied by the guaranty of responsible sureties to furnish bond, as required, if the contract is awarded to the bidder. The right is reserved to reject any and all bids and to waive technical defects if the interest of the Government requires it. Bidders are invited to be present at the opening of the proposals. Proposals must be marked "Proposals for Telephone System, Fort Buford Project, Montana and North Dakota." E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Washington, D. C., May 1, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, 1108 Braly Building, Los Angeles, Cal., until 2 o'clock p. m., Monday June 5, 1905, for the construction of the Laguna Dam and Sluiceways, involving the excavation of about 282,000 cubic yards of earth, excavation of about 305,000 cubic yards of solid rock, placing of about 305,000 cubic yards of solid rock in the dam and masonry core walls, building of about 27,150 cubic yards of concrete, laying of about 80,000 square yards of paving, and furnishing and driving of about 53,000 linear feet of sheet-piling, for the diversion of a part of the Colorado River about 10 miles northeast of Yuma, Ariz. Bids will be received for the entire work or any integral part thereof. Specifications, form of proposal, and particulars may be obtained by application to the Chief Engineer, U. S. Reclamation Service, Washington, D. C.; to J. B. Lippincott, Supervising Engineer, U. S. Reclamation Service, 1108 Braly Building, Los Angeles, Cal., or to Homer Hamlin, Engineer, U. S. Reclamation Service, Yuma, Ariz., at whose offices the plans may be inspected. Each bid must be accompanied by a certified check for \$10,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 20 per cent of the contract price for the faithful performance of the work. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the service may require. Proposals must be marked "Proposals Laguna Dam, Yuma Project, California." Bidders are invited to be present when bids are opened. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR. United States Geological Survey, Reclamation Service, Washington, D. C., April 29, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Billings, Montana, until 2 o'clock p. m., June 28, 1905, and thereafter opened, for the construction of pumping station, concrete culverts, siphons, drops, etc., and furnishing two steel highway bridges, four steel sluice gates with stands, and 120,000 pounds steel bars for reinforcing concrete. Total amount of concrete about 1,600 cubic yards. Above work to be done along line of canal east from Huntley, Montana, in connection with the Huntley project. Specifications, form of proposal, and plans may be obtained at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., or from R. S. Stockton, Engineer, Billings, Montana. Each bid must be accompanied by a certified check for \$1,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of \$10,000 for the faithful performance of the work. It must also be accompanied by the guaranty of responsible sureties to furnish bond as required if the bid be accepted. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the service may require. Bidders are invited to be present. Proposals must be marked "Proposal for building structures and furnishing material, Huntley project, Montana." E. A. HITCHCOCK, Secretary.

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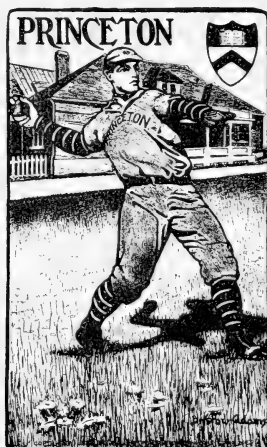
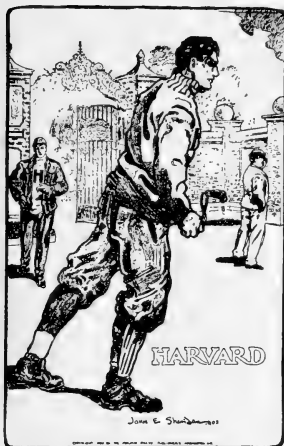
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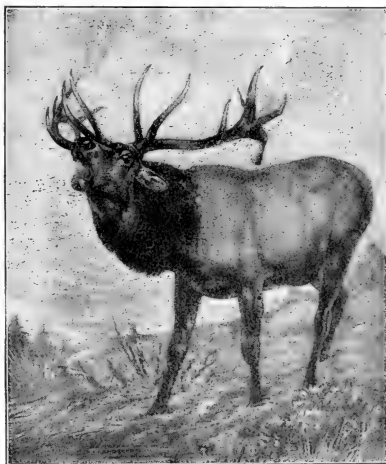
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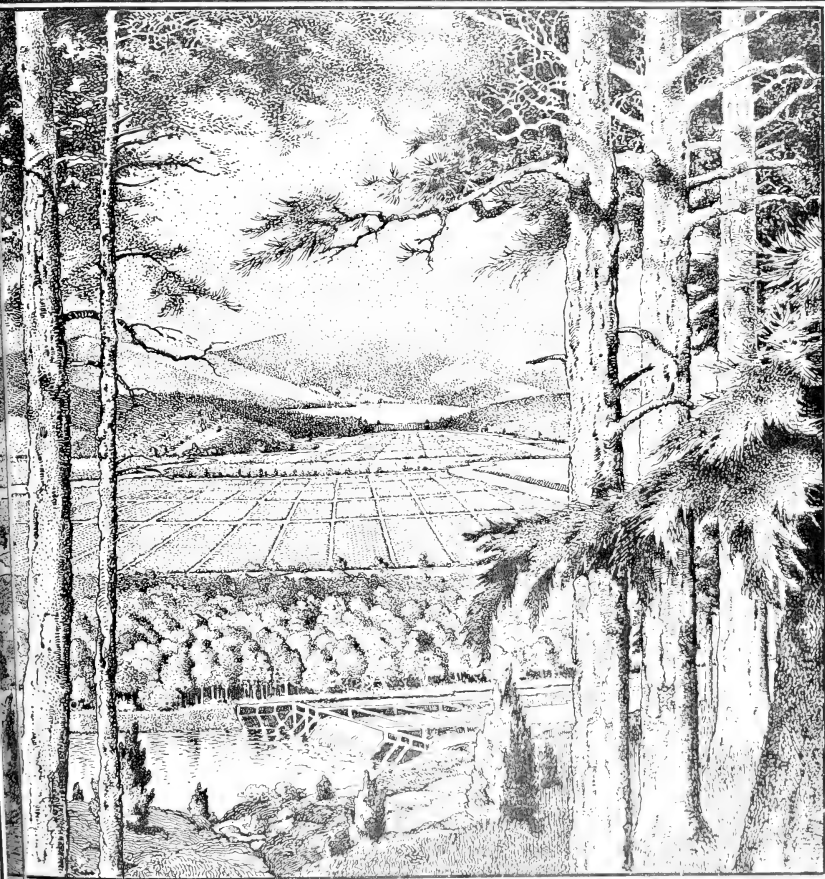
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The Proceedings

OF THE

American Forest Congress

recently held at Washington, D. C.,
have been published in book form

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Forestry and Irrigation

H. M. SUTER, Editor

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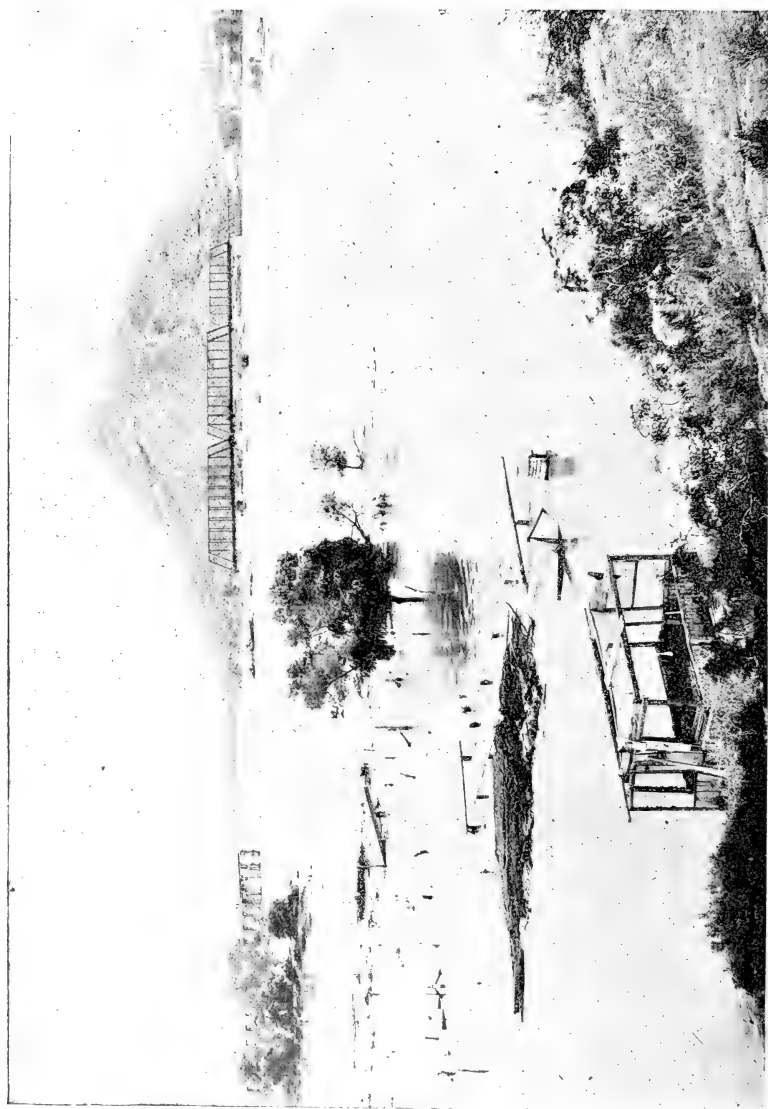
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WASHINGTON, D. C.

JOHN E. SHERIDAN



The Recent Flood in Salt River Valley, Arizona. View looking toward Tempe Butte from the North end of the Southern Pacific railroad bridge, showing flooded forms on the North side of Salt River; also Santa Fe's wrecked bridge caused by flood on the night of April 12th, 1905.

Forestry and Irrigation.

VOL. XI.

JUNE, 1905.

No. 6

NEWS AND NOTES

Proceedings Issued

The proceedings of the American Forest Congress have just been issued in book form. The volume contains about 480 pages, and includes every paper read at the various sessions of the Congress, and a large number of the more important impromptu addresses, and is substantially and neatly bound in green cloth. The American Forest Congress, held at Washington, D. C., January 2 to 5, was, according to President Roosevelt, "A meeting which is without parallel in the history of forestry," and this volume, with its complete record of the proceedings, is the most authoritative publication that has been issued on the subject of American forestry. The H. M. Suter Publishing Company, P. O. Box 356, Washington, D. C., are issuing the book. It is sold for \$1.25 a copy post paid.

Putting into effect a law

Game Reserve

passed by the last session of Congress, the

President has proclaimed the whole Wichita Forest Reserve a game preserve. The reserve is in Oklahoma Territory, and contains 57,120 acres. Declaring it a game preserve takes away none of its functions as a reserve, it merely suspends all territorial game laws. In the future, under regulations prescribed by the Secretary of Agriculture, game, especially quail and wild turkeys, will be protected and encouraged to propagate in the preserve.

Forestry on a Private Reserve

The Bureau of Forestry has been called upon to devise a plan by which the owner of a forest on a summer resort island may cut the timber with-

out impairing the scenic effect of the forest. It is a hardwood forest of about 7,000 acres, and covers half of Manitou Island, Lake Michigan. About half the forest is virgin timber. The owner desires a steady product, but to have the cutting done in such a way that the forest will remain an attraction of the island. Mr. S. J. Record, of the Bureau, is in charge of the work, and will be assisted by four field men.

Oklahoma Land With- drawals

The Commissioner of the General Land Office has temporarily withdrawn from any form of disposition whatever, the following lands in the Territory of Oklahoma, in connection with the Navajo reservoir site on Red River:

Indian meridian T. 2 N., R. 18 W., Sections 4 and 5.

T. 5 N., R. 18 W., Sections 6, 7, 17, 18, 19, 20, 28, 29, 30, 31, 32, 33.

T. 3 N., R. 19 W., Sections 1, 2, 3, 9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 14, 25, 16, 36.

T. 4 N., R. 18 W., Sections 5, 6, 7, 8, 17, 18, 19, 30, 31.

T. 4 N., R. 19 W., Sections 1, 2, 3, 11, 12, 13, 14, 22, 23, 24, 25, 26, 27, 34, 35, 36.

T. 5 N., R. 19 W., Sections 34, 35, 36.

Co-operative Forest Work

The Bureau of Forestry has begun another co-operative piece of work with the Northern Pacific Railroad. It is an investigation of the problem of a future supply of railroad ties for the section of the line east of Montana. The present eastern supply will last, at the outside, not longer than fifteen years, and the railroad is anx-

ious to know whether it will be cheaper to haul from its holdings in the Rocky Mountains the million ties needed annually for the eastern line, or to grow them somewhere in Minnesota or Wisconsin. These states are preferred as they are near the railroad and cheap land can be secured there. The investigation by the Bureau will establish the possibility and the cost of producing ties in these states. If ties are brought from the Rockies they would probably be of lodgepole pine; if grown in Minnesota or Wisconsin some of the inferior hardwoods or possibly pine would be preferred. The result of this study will be of interest to all railroads, since the tie supply question is one of increasingly great importance. Mr. H. H. Chapman, the bureau agent, who will be in charge of the work, has started his investigations, which will cover several months.

Another application has been received by the Bureau of Forestry for a preliminary examination of a watershed on the chaparral-covered slopes of the mountains of Southern California, this being the third of the kind received within the last few weeks. These requests are largely the result of the experimental work in reforestation which has been carried on by the Bureau of Forestry in the San Gabriel Mountains back of Pasadena. The growing value of water and the realization that the chaparral cover does not satisfactorily retain the precipitation, has led many irrigation companies to seriously consider the subject. This last application was from an irrigation company in Santa Ana, Orange County, and their desire is to reforest, if possible, the drainage basin of Santiago Creek in the Santa Ana Mountains. At present the run-off is very rapid during the heavy rains, and the flow of the stream deficient in summer. This follows as the result of repeated fires in chaparral and the denuded condition of many slopes.

Agents of the Bureau of Forestry

have commenced to make maps of the southern part of New Hampshire which will show the timber land, the agricultural land, and the barren areas suitable for tree planting. This work is done in coöperation with New Hampshire, and some 4,000,000 acres will be mapped this summer. Forest work in the state will be done chiefly with the view of advising farmers and owners of second-growth forest as to the best management for the production of pulp wood, box boards, fire wood, etc. Another object is to complete a forest policy for the state, covering legislation upon fire and forest taxation, also a system to protect timberland and to encourage conservative forest management. Mr. C. A. Lyford, agent of the Bureau of Forestry, detailed in charge of this work, is now in New Hampshire in consultation with its State Forest Commission. He will be assisted in his work by some ten or more bureau field men.

Grazing Inspection

Mr. A. F. Potter, forest inspector, left yesterday for the west to make special investigations relating to grazing in the forest reserves. He will cover Utah, Wyoming and Montana in the early part of the season, and California in the fall.

Reclamation Appointments and Transfers

Among the recent appointments, assignments and transfers in the U. S. Reclamation Service the following are noted:

Clayton W. Bowles, of Orono, Maine, has received an appointment as engineering aid and directed to report to F. E. Weymouth, Glendive, Montana. Mr. Bowles took a course in civil engineering in the 1905 class, University of Maine, and has had experience in connection with the Fort Buford project, North Dakota, during 1904.

Harold N. Cross, of Exeter, N. H., has been appointed assistant engineer, and will report for duty to F. E. Weymouth, Glendive, Mont. He graduated from the Thayer School of Civil

Engineering and had one year post-graduate work. Mr. Cross worked during the summer of 1903 in New York city; he also had four years in sanitary engineering in the Massachusetts Institute of Technology.

Walter B. Freeman has been appointed hydrographic aid and assigned to duty under C. C. Babb, Browning, Montana.

Lewis E. Foster, appointed engineering aid, will report at Glendive, Montana to assist in soil classification work. An experienced orchardist, Mr. Foster is well qualified for work in bureau of soils. He has had considerable experience in surveying.

Frank H. Brundage, assistant engineer in the Reclamation Service, has been directed to report to J. Ahern, Cody, Wyoming.

Ralph C. Soper, engineering aid in the Reclamation Service, will report for duty to J. Ahern, Cody, Wyoming.

Albert E. Wood, of Cleveland, O., has received an appointment as engineering aid and directed to report to J. E. Field, Fort Laramie, Wyoming. Mr. Wood graduated from Fayette Normal School with the degree of B. S., and is now a senior in civil engineering, Case School of Applied Sciences.

Carl R. Weitze, of Clinton, Mass., and a graduate of Scientific School of Harvard University with degree of C. E., has been appointed engineering aid and directed to report to C. W. Smith on Roosevelt dam, Arizona. Mr. Weitze has had considerable experience in engineering for State of Massachusetts, and also acted as instructor in plane, railroad and geodetic surveying at Swuain Lake, N. H.

Wm. E. Martin, of Texas, has been appointed hydrographic aid and will assist W. B. Clapp in hydrographic work at Los Angeles, California. Mr. Martin graduated from Sam Houston State Normal School, Huntsville, Texas, and from the University of Texas, at Austin. He has worked in railroad location and stream gaging,

and made experiments regarding the evaporation of water.

Wm. A. Lamb, Denver, Colo., graduate of Colorado State Agricultural College, has been appointed engineering aid and will act as field assistant to M. C. Hinderlider. He has had considerable experience in hydrographic work and has been engaged during the past year by the U. S. Geological Survey.

Leroy F. Harza, of Madison, Wisconsin, engineering aid, has been assigned to duty under C. S. Slichter, Madison, Wis. Mr. Harza attended the South Dakota Agricultural College and is now taking a scientific course in the University of Wisconsin. He was county surveyor of Moody County, S. D., for two years and has been engaged in surveying for sewer location.

Walter B. Harrington, of Wadsworth, Nevada, has been appointed engineering aid and will be engaged under supervising engineer L. H. Taylor, with whom he is now associated as "field assistant." Mr. Harrington graduated from the University of Nevada as mining engineer and has been employed on the Truckee high line canal under the direction of Prof. Chandler.

Frederick L. Humphrey, of New York city, has been appointed engineering aid and will be engaged for some time in the Washington office of the Reclamation Service. Mr. Humphrey has had extensive experience in civil engineering in connection with his college course in the Columbia University, New York city.

Edward L. Edes, of Reading, Mass., has received an appointment as engineering aid and requested to report to G. L. Swendsen, Salt Lake City, Utah. Mr. Edes, who is taking a course in the Massachusetts Institute of Technology, has had practical experience in connection with his college course in civil engineering.

Frederick A. Biggi, of New York city, has received an appointment as engineering aid in the Reclamation Service, and will be engaged at pres-

ent in the Washington office. Mr. Biggi graduated from the Massachusetts Institute of Technology with the degree of C. E., and has been engaged in various capacities of surveying, drafting, etc., by the city of Boston.

Adolph H. Rossing, of Madison, Wis., has been appointed engineering aid and ordered to report for duty to J. E. Field, at Fort Laramie, Wyoming. Mr. Rossing took a general scientific course in the University of Wisconsin and graduated from the college of Mechanics and Engineering with the degree of C. E.

Verney W. Russell, of New Hampshire, has received an appointment as engineering aid and directed to report for duty at Cody, Wyoming. Mr. Russell graduated from Dartmouth College and had considerable experience in connection with his college work.

Tree Planting by the Bureau

The planting operations of the Bureau of Forestry is carrying on in cooperation with the Delaware and Hudson Railway Company along their Chateaugay Division in the Adirondacks, is progressing rapidly. G. B. Lull, of the Bureau of Forestry, is in charge of the work. The nursery which is being established at Wolf Pond is nearly completed, and will have a capacity of 300,000 plants. In addition seeds will be planted on denuded areas by the seedspot method. The object of the work is to reforest the 28,000 acres of land along the railroad, which have been denuded by lumbering and repeated fires. With the growing scarcity and increased cost of cross ties, the importance of this work can hardly be overestimated. The most promising species used is the European larch, as it grows rapidly, is easily propagated, and is of high value for posts, telephone poles and railroad ties. The other species which are being planted are Scotch pine, white pine, and Norway spruce.

The season's forest planting operations have been begun in the Pikes Peak Forest Reserve. F. W. Besley,

of the Bureau of Forestry, has gone from the Dismal River Reserve to Colorado to begin this work. He will direct the planting of 50,000 trees which were grown in the Dismal River Reserve Nursery, and will plant additional seedbeds and care for the three forest nurseries established near Pikes Peak last year. This work follows a carefully prepared preliminary reforestation plan made in 1903 and 1904.

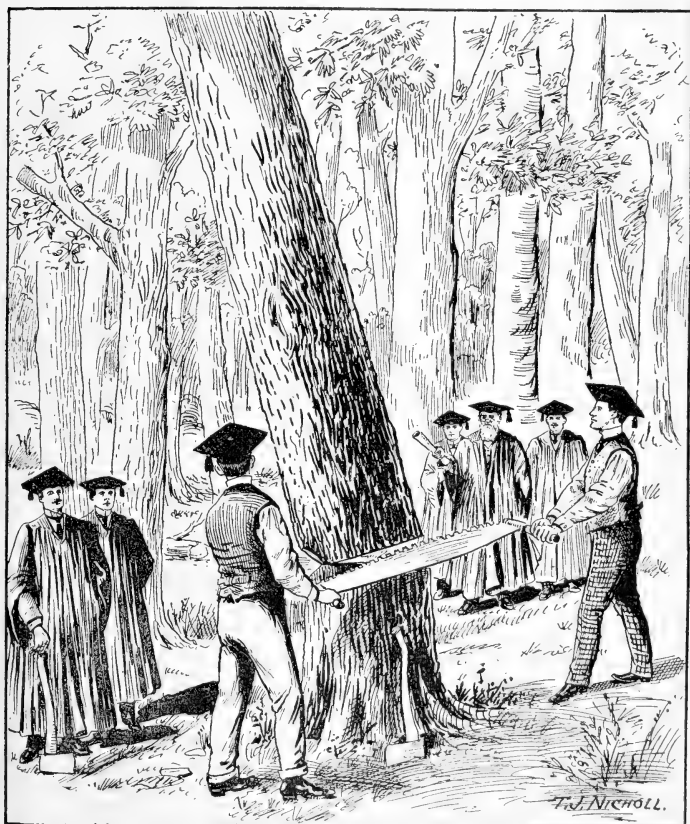
New Forest Reserves

The President has proclaimed another reserve in Idaho. It is called the Sawtooth Forest Reserve, is located in the southern-central part of the state, and contains something over 1,900,000 acres. It is well timbered, practically all unsurveyed, and has no settlements except a few small mining camps. The region is very rough, and has few roads and trails. The land has no agricultural value, but is important for its forests, stock range and mineral resources. The reserve is created to protect the timber, but more particularly to protect the watershed of the Boise River, and thus to make possible the success of the Boise Valley irrigation project, upon which depends the agricultural future of the region.

The President has proclaimed two more forest reserves, the San Juan in southeastern Colorado, and the Payette in central Idaho. Each reserve is about the same size, something under 1,500,000 acres. The chief purpose in creating each reserve is to better protect watersheds upon which depend vast areas that can be reclaimed to agriculture by irrigation. The land irrigable by streams from the San Juan reserve extends beyond the border of Colorado into New Mexico. The timber in neither reserve is at present very valuable, but it will improve with time, especially if fire is kept out. In the San Juan area there has been some overgrazing, to the injury of both the forest and the range. In the Payette reserve the land is very rough and the soil poor, while half

THE NEW SCHOOL OF LUMBERING

[At the annual meeting of the National Lumber Manufacturers' Association, held at Chicago in May, it was resolved to lend its aid to the endowment of a chair of lumbering at the Yale Forest School.]



PRACTICAL WOODS WORK

Professor—Now, young gentlemen, when the angle of declination of the bole of this perennial woody plant reaches—never mind the scientific exposition—scoot!

—*The Hardwood Record.*

of the area is inaccessible to grazing. Under Forest Service regulations the timber and the range will be improved, and agricultural conditions will be vastly benefitted.

Planting Plan S. B. Detwiler has gone for Gunnison to Colorado to carry on, Reserve in the newly created Gunnison Forest Reserve, forest replacement studies for the Bureau of Forestry. The object in view is the preparation of a preliminary reforestation plan for this region. Similar plans have been made for other reserves where planting work is now in progress, and are necessary in order to determine areas that are suitable, or unsuitable, for planting, and the watersheds which are in the most urgent need of attention. The work in the Gunnison Reserve is particularly important because of the large irrigation projects which are under way. Since the condition of the forest cover on the slopes above reservoir sites determines to a large extent the quality and regularity of the water supply, any action which leads to a reforestation of denuded slopes will add just so much to the irrigation possibilities of the region. Mr. Detwiler's report, when completed, will show the areas which should be planted at once, those which are not in such urgent need, the tree species to be used, where forest nurseries should be located, and will contain an approximate estimate of the cost of all contemplated operations.

**Irrigation
Contracts
Awarded**

The Secretary of the Interior has awarded contracts to the lowest bidders for construction of the Interstate Canal, North Platte project, Nebraska, as follows:

Robinson & Maney, St. Louis, Divisions 1, 2, 6, 7, 9 and 10; Griffith & McDermott, Chicago, Division 3; Deadwood Construction Co., Division 4; Orman & Crook, Pueblo, Colo., Division 5; James O'Connor, Morgantown, Ind., Division 6.

The lowest bids on the several divisions are as follows:

1. Robinson & Maney, \$40,599.
2. Robinson & Maney, \$42,332.
3. Griffith & McDermott, \$78,135.
4. Deadwood Const. Co., \$32,695.
5. Orman & Crook, \$76,647.
6. Robinson & Maney, \$35,335.
7. Robinson & Maney, \$35,135.
8. James O'Connor, \$37,560.
9. Robinson & Maney, \$33,266.80.
10. Robinson & Maney, \$29,700.

Transplanting Seedlings Contrary to prevalent belief, the famous "Big Trees" of California do reproduce themselves under certain favorable conditions. The trees seed freely, but the seed rarely germinate except when they fall where the ground has recently been burned over. Once started the young growth only needs a moderate amount of light and protection from fire and stock grazing. With some care this race of forest monarchs need not become extinct, but may be greatly multiplied. The number of mature trees is not great, and healthy young growth is rare, but in some situations there are plenty of seedlings. In order to establish these trees more widely, it is proposed to move some of the seedlings to localities where they will be apt to grow.

The first extensive transplanting of the "Big Trees" has recently been finished by Ranger Lewis L. Davis in the General Grant National Park, California. In the spring of 1904 it was noticed that a large number of tiny sequoias sprang up where debris had been burned. Advantage was taken of the opportunity to place the seedlings which appeared where they would have opportunity to develop. Ranger Davis has thus far transplanted about 1,400, and those set last year have nearly all grown.

Telephone for Dismal River Reserve The Forest Service men in charge of the planting and nursery work on the Dismal River Forest Reserve, Nebraska, have taken advantage of the numerous barb-wire fences of the region to install a complete telephone system by stringing a few connecting wires, and mending breaks and put-

ting in insulators where needed. They have connected their headquarters with ranches throughout the surrounding country, and with small towns in the neighborhood. This not only gives them social advantages, but enables them to order supplies or to receive prompt information in case forest fires are discovered.

Timber Cutting in Forest Reserves Timber sale transactions and the actual cutting in progress on the government forest reserves now involve a fraction under 91,000,000 board feet of lumber, 50,913 cords of wood, 513,000 railroad ties, and 36,885 posts, poles, and staves. This is outside the free use of wood for local domestic and farm purposes, which aggregates a large amount. It is conclusive proof that the mature timber on the reserves is for use, and the Forest Service will continue to dispose of it as rapidly as possible in the interest of the public, and in order to improve the condition of the forests.

To Test Materials

An interesting meeting, and one which will have far-reaching influence in solving many vital economic questions, has just been held in Washington. The meeting was a conference between prominent engineers and officials of the U. S. Geological Survey and the Bureau of Forestry on the problems connected with the testing of structural materials, such as stone, cement and timber.

The extensive program which has been outlined as a result of this meeting is of special significance to the Reclamation Service, as no feature in connection with the construction of the government's irrigation works is of more vital importance than the character, durability and strength of the materials which enter into their formation.

The wide interest which is felt in these investigations was evident in the presence of representative members of many of the leading corporations of the country, who expressed their desire to cooperate in the work. The fol-

lowing gentlemen attended the meeting:

Dr. C. B. Dudley, chairman of the conference, president American Society for Testing Materials, chief chemist Pennsylvania Railroad; C. C. Schneider, president American Society of Civil Engineers; R. L. Humphrey, president American Society of Cement Users and cement expert U. S. Geological Survey; R. W. Lesley, vice-president American Society for Testing Materials, editor *Cement Age*; G. S. Webster, chief engineer City of Philadelphia; E. A. Foose, representing Mr. J. E. Muhlfeld, general superintendent of Motive Power, Baltimore and Ohio Railroad; E. F. Kenney, representing Mr. Joseph T. Richards, chief engineer Pennsylvania Railroad, Philadelphia; Mr. Burleigh, representing Mr. James K. Taylor, supervising architect of the Treasury; A. A. Robinson, representing Mr. James Dunn, chief engineer Santa Fé Railway, Chicago; D. W. Lum, chief engineer Southern Railway; W. C. Cushing, chief engineer Pennsylvania lines west of Pittsburgh; J. E. Deems, general superintendent of motive power, New York Central and Hudson River Railway; C. H. Buckingham, supervisor of fuels, New York Central and Hudson River Railway; J. E. Greiner, representing Mr. D. D. Caruthers, chief engineer, Baltimore and Ohio Railroad; F. H. Newell, chief engineer Reclamation Service; Gifford Pinchot, Forester, U. S. Department of Agriculture; Prof. J. A. Holmes, in charge of testing work of the U. S. Geological Survey; W. L. Hall, in charge of testing work for Bureau of Forestry.

Arrangements have been made for a continuous advisory board to work with the Bureau of Forestry and the Geological Survey in the conduct of their official tests. This cooperation will mean that in advance of any tests these bureaus will have the benefit of the suggestions and advice of the foremost engineers of the country in special lines of work. It is the first time in the history of our government that

such coöperation has been effected, and it is believed that the relations thus established will result in more expeditious and satisfactory work, and will prove of great economic advantage to both public and private interests.

The initial work, that of analyzing and testing the relative steam producing powers of coals and lignites of the United States, which was inaugurated during the summer of 1904, at St. Louis, will also be continued. The various portions of the plant were contributed by different manufacturing companies, and the railroads entering St. Louis or having coal resources along their lines coöperated most heartily with the committee in charge of the work. The results of this work are very interesting and valuable.

Plan for Planting Coal Lands

A planting plan for a portion of the lands of the Keystone Coal and Coke Company, of Greensburg, Pa., has just been finished by the Bureau of Forestry. This company owns several thousand acres overlying coal beds. It is proposed by the planting of rapid-growing trees to make these lands more productive than under the old plan of renting on shares for agricultural purposes. A small nursery was established and several thousand young chestnut and maple trees were set out this spring. A detailed planting plan was also prepared giving directions for future operations. Black locust is the species which will be mainly used.

To Plant Watersheds

A planting plan for certain important watersheds, and recommendations for the treatment of lands in the interior of the San Gabriel Forest Reserve, California, have just been completed by Mr. A. T. Searle, of the Bureau of Forestry. This report considers the possibilities of planting on various types of denuded and chaparral covered land in these mountains, and embodies recommendations as to the species which should be used, methods of planting, and locates the

slopes which are in the most urgent need of attention. These recommendations are based on experience gained in experimental work which has been under way for several years and are intended to give a definite, systematic plan of procedure for future operations. The chaparral growth has been divided into five well defined types which require special treatment. The most hardy species, such as knob-cone, Monterey, and Digger pine will be planted in the more unfavorable situations, while the more valuable but less hardy trees, such as yellow, sugar, and Coulter pine, and spruce and cedar, will be planted on the more favorable sites.

Forest Students Chosen

The Bureau of Forestry has completed the selection of forest students for the coming season. The men were chosen from the most promising students of forest schools and will be assigned for the summer to the collection of data, under the direction of trained foresters, in various lines of the Bureau's activities. There will be 29 such students appointed July 1, from a total of about 200 applicants.

Planting in Black Hills

Planting operations in the Black Hills Forest Reserve are being pushed rapidly under the direction of L. C. Miller, of the Forest Service. A recent examination has revealed such favorable conditions that it has been decided not to use nursery stock extensively in reforesting the denuded areas. Instead, several hundred pounds of seed will be sown directly on the land where trees are desired. In order to compare the nursery method with that of direct sowing, about 50,000 small trees grown in the Dismal River Reserve nursery, in Nebraska, will be set out. The region in which operations are under way is in the vicinity of Custer Peak, where lumbering and fire have denuded the ground. The season thus far has been unusually rainy, and while it has delayed operations it will ultimately contribute much to the success of the work.

RECENT CONDITIONS IN SALT RIVER VALLEY, ARIZONA

BY

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THE unusual meteorological conditions which have prevailed throughout the United States during the early part of the present year have made themselves peculiarly felt in the arid regions of the southwest. Weeks

an unwonted aspect of verdure with their luxuriant growths of grass, weeds and cacti, and in places the once barren desert soil is covered with a vegetation so rank and prolific as to savor of tropical conditions. My-



View showing the remaining portion of the Arizona dam, which was washed away by the Flood of April 13.

of continued rainfall, alternating with cloudiness, have produced a change in the aspect of the desert lands, particularly at the lower levels, which is the more remarkable, following as it does a series of exceedingly dry years. The deserts of Arizona have assumed

riads of wild flowers, among them many a rare species, such as the lily of the desert, covered the plains and foothills during April and May, like a brilliant carpet painting the landscape with the most gorgeous of hues, and causing the traveler gazing upon

this lavish display of western flora to revel in the splendor of the scene and to wonder at the productiveness of the desert soil.

While the copious snows and rains have proven of inestimable value to the stock ranges on the high plateaus and to the agricultural interests in the valleys, incalculable damage has been inflicted by floods to property of all kinds. In the populated districts of Arizona, and in the Salt River Valley more in particular, the excessive precipitation has been the cause of washouts along the railroads, wagon-roads, canals, ditches, telegraph and telephone lines, to an extent unparalleled in the history of the valley. The

be washed out by a subsequent rise of the Gila River, and although no expense was spared by the railroad company in rebuilding the structure, it met with the same misfortune time and again, until on March 31 the bridge has been successively destroyed and rebuilt eight times. The same company on April 13 lost the south approach to its bridge across Salt River. This bridge, at the time the accident occurred, was the only means then available for crossing the Salt River for many hundred miles either up or down the river, and its partial failure for a while made all crossing impracticable. The line of the Phoenix and Eastern Railroad, extending



View of the Capitol, Phoenix, Ariz., February 4, showing how the grounds were flooded by waters from Cave Creek.

city of Phoenix, situated in the center of Salt River Valley, and dependent on branch railroads for connection with the main lines of the Southern Pacific and Santa Fe systems, has been a principal sufferer from the repeated interruptions in traffic and means of communication during the months of January, February, March and April. Early in January the Maricopa, Phoenix and Salt River Valley Railroad lost its pile bridge across the Gila River near Sacation station during a flood, and up to April 1 but little traffic was had over that line. The bridge was rebuilt only to

from Phoenix to Kelvin, Arizona, lost its bridges across both Salt and Gila Rivers, the former a steel bridge, being partly destroyed March 20 through the shifting of the river bed and undermining of two of its piers. Much depended on the maintenance of the two railroad bridges across Salt River, for during five months that stream was unfordable and the only means of crossing it were afforded by these bridges. The Santa Fe, Prescott and Phoenix Railway met with a number of washouts, but succeeded, in spite of delays, in running trains. The main lines of the Southern Pacific and the

Santa Fe systems, and a number of less important railroads suffered from repeated washouts and interruptions in traffic. Principal among the latter is the Gila Valley, Globe and Northern Railway, which lost its bridges and many miles of track along the banks of the Gila River by the caving and washing away of the banks.

Several times during the period referred to Phoenix was cut off from all communication with the outer world, as a result of these washouts. Aside from the main rivers many of the smaller tributaries did much damage.

tol is located was flooded to a considerable extent, the water covering the capitol grounds to a depth of nearly two feet. With its boggy streets emitting a foul odor and a humid atmosphere which would have done credit to a tropical climate, Phoenix was not a desirable abode during the period under consideration for the consumptives and other invalids, who habitually spend the winter months there in search of health.

The ranchers of Salt River Valley sustained damage in many different ways. One after another the diver-



Street scene near the Capitol, Phoenix, Ariz., February 4, showing flood waters from Cave Creek.

Cave Creek, a small torrential stream entering Salt River Valley northwest of Phoenix, was the cause of repeated inundations of a large section of the Salt River Valley, seriously damaging crops, ditches and highways. In several instances the discharge from this creek was so large in volume that the canals in the valley were unable to drain it off, and overflowing them, the water reached the western portion of the city of Phoenix. At one time that section of Phoenix in which the capi-

sion dams maintained across Salt River by the various irrigation enterprises were washed out, and when the waters finally commenced to subside the owners found themselves confronted with difficult problems regarding the reconstruction of these dams, the majority of which had been of a more or less temporary character. All along the river sweeping changes occurred in the river bed, and in more than one instance the new channel was found to be located a long distance

away from the old canal head. The continued high water, moreover, rendered it impracticable to reconstruct these dams in season to turn irrigation water in the ditches for the spring irrigation, and at many points in the valley irrigators were left without water for a considerable period. Fortunately for them, however, the copious rains which had previously soaked the soil proved to be the salvation of many a crop.

One of the most serious calamities to the people of Salt River Valley oc-

by the Arizona Water Company, made immediate preparations to restore their former headgates and soon were able to supply the ranches situated under them with irrigating water. The Arizona Water Company is also preparing to rebuild its dam.

The protracted floods on Salt River in addition to destroying the works of man, did incalculable damage to lands along the river, through the shifting of the river bed and the caving of the banks. At numerous points along the river ravages of this nature assumed



Bridge of the Phoenix and Eastern Railroad across Salt River, damaged by high waters March 20.

curred on April 13, when a high flood destroyed the timber dam of the Arizona Water Company, commonly known as the Arizona Dam. This structure practically controlled all irrigation water used on the north side of the river, and its loss was a serious blow, more especially to the orchards in the northern part of the valley. The older canals known as the Salt River Valley, Maricopa, and Grand Canals, which had been supplied with water

large proportions, ranches of large acreage being cut down to small holdings, and in some cases entire ranches disappeared little by little, inclusive of barns and buildings, leaving the owners destitute. At Tempe the river cut into the banks east of the Tempe Buttes, which protect the town on the north side against the river, carrying away many acres of valuable farm land. Considerable apprehension has been entertained by the citizens of that

locality, who fear that the river will form a new channel to the south of the Buttes and through the heart of the community. At Roosevelt, Arizona, where the engineers of the Reclamation Service have been actively engaged during the past months on the preliminaries to the construction of the great Roosevelt dam, work on the power canal and the operating of the cement mill were seriously interfered with as a direct result of the exceptional weather conditions. Cut off from all communication with the outside world for days at a time, it was with the utmost difficulty only that the large construction camps were supplied with food, forage, fuel, tools, and other supplies. The stage roads from Mesa to Roosevelt and Globe to Roosevelt presented for months the sorry spectacle of innumerable abandoned freight wagons, mired to the hubs, loaded with goods of all kinds, among them oil tanks with fuel oil for the government cement mill. That portion of the road from Mesa to Roosevelt which was constructed by the Reclamation Service at considerable expense, suffered but little from washouts. Rumors which were circulated some time ago to the effect that it had been washed out over a distance of eighteen miles are without foundation.

A glance at the records of the Weather Bureau becomes of interest in this connection. Throughout the central portion of Arizona and especially at the high elevations, the precipitation during January, February, March, and April has been marked by frequent and unusually heavy rainfalls. The Phoenix record shows a rainfall of 3.31 inches during January; 4.64 during February; 2.38 inches during March, and 2.59 inches during April, a total of 12.92 inches for the four months. This represents an accumulated excess of 10.04 inches over and

above the average for the same period during the past ten years. The normal annual precipitation at Phoenix being less than 7 inches, it will be noted that the accumulated excess for the period January 1 to April 30, 1905, as given above, is in itself greater than the yearly normal. The number of rainy days observed during the four months referred to is 48; cloudy days, 78; clear days, 42. Of this February had 14 rainy days, 22 cloudy days and only 6 clear days. Indeed, exceptional records for the Salt River Valley! On the high plateaus the records are also remarkable, the precipitation having amounted to as much as from 25 to 37 inches of snow in different localities, during single months of the period under consideration. The large snowfalls in the mountains are responsible for the fact that the rivers of Arizona toward the end of May were still discharging large quantities of water. On many peaks snow remained till late in May.

It is estimated that the discharge of Salt River above its confluence with the Verde has averaged during February and March in the neighborhood of 10,000 cubic feet per second. The flow during these two months alone would have been ample to more than fill the projected reservoir at Roosevelt. It is of peculiar interest in this connection to note that observations by engineers of the Reclamation Service indicate a marked rise in the underground water level in the Salt River Valley, and a gradual diminution in the amounts of salts and mud contained in the river water during the long period of high water. While accurate figures on this subject are not yet available for publication, it is expected that the data collected will lead to conclusions of particular interest to the irrigator as well as to the scientist.

EUROPEAN STUDY FOR FORESTERS

BY

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WITH our insufficient forest literature and meagre understanding of the subject, a short period of travel may be said to be almost indispensable to a thorough study of forest management. We have no demonstration forests and many of our forest school professors have never themselves seen European forests. To this is added the fact that our young foresters are sometimes confronted by problems puzzling even to an expert of twenty years' experience. Other countries have set us an example which may be well followed. Japanese forest students are to be found in Germany, France, and in India. English students from Coopers Hill formerly spent six weeks on tour in Germany and a few weeks in France; recently eight months' detailed work under a German forester has been added to the educational requirements. German students, it is true, seldom study outside their own states. Each state has its own particular method, long established, and they have not so much need of foreign study. At their schools during good weather, the Saturdays are usually spent in the forests of the different districts. Yet one of the foremost German professors told me that he had learned a great deal, both in India and Japan. If a German professor finds such trips worth while, how much more valuable would they be to the American forester?

Granted that American foresters recognize the necessity for study abroad, why is it that so few are going? Of the forest school graduates now in the employ of the United States Bureau of Forestry, there are only a few who have had European training. There are three chief reasons: (1) The present number of trained men is insufficient to properly

handle the work. The demand for trained foresters is greater than the supply. In a few years this shortage will be supplied by the new men pouring out from the schools. There will then be greater competition and only the well trained men will secure employment. This will naturally lead to a more thorough preparation by European study. (2) At present the desire to begin work as soon as possible and hence partake in the early advancement undoubtedly prevents some men from studying abroad. The fact that the right sort of study abroad will make better all-around foresters ought to deter men from such a view. It is quite within the power of government and state management to count time spent in European study as actual service. This is not unfair, and is the method of the more advanced universities. If the ability of two men is equal and one spends time in practical work, which the other puts into studying new methods, the employer would probably get better results from the latter of the two men in the long run. (3) Want of funds is perhaps one of the greatest hindrances. Under the present rules a man must consider loss of salary while on leave, as well as his extra expenses, and in addition to this a lower salary due to deferred promotion, owing to absence. At present the leave of members of the Bureau of Forestry is wiped out at the end of each fiscal year. In the Philippine Bureau, leave is cumulative up to three years. With this privilege in the United States (applicable only to leave taken for purposes of study) a man could spend three months in Germany drawing full pay which would almost pay for his trip. In time it might even be possible for men to be sent abroad on a collaborator's salary

and expenses, in order to report on special subjects. This would benefit the men and at the same time add to our scanty forest literature. When Indian forest officers are willing to spend their leave in study, they receive a travelling allowance, as well as their full pay. In order to induce European study it might even be desirable to require a monograph on some European system before advancing a man to pay of \$1,500 per annum.

One of the objections to the run of German foresters is that they find it hard to accept new and advanced ideas on thinnings, reproduction, etc. They perhaps read about such topics but do not become familiar enough with the problem to actually put it in practice. We might guard against such stagnation by founding a short post graduate course at one of the best schools and require attendance from men in government employ after some years of service. In such a short course only new and important topics would be discussed. By such personal discussion men tucked away on forest reserves would be enabled to keep in touch with the latest ideas far better than by reading. Such a system would be in line with the war college which our navy has established at Newport.

The question often arises whether a man should study abroad immediately after graduation from a forest school, or later. From the employer's standpoint the former is better. Fewer mistakes would be made. From the student's standpoint it seems better to engage in practical work for a year or so before completing his technical education. After two years of hard study at a forest school, most men begin to tire of books and want to put their ideas into practice. After a year's work they are in a better position to know just what they want to study. It is not necessary for the graduate to spend a long time in one country. With his forest school training to start with, four to five months would be sufficient for Germany; the

first month spent in one place studying the language and the details of the management of that forest. With the details of one forest well in hand, a comparatively hurried tour will be of far more value. It seems to me that Americans are apt to make far too hasty tours, and this without a preliminary month of preparation. It is a fact that spending only a few hours in a forest when on tour often gives one a false impression. It is only natural that the forester should always show his best reproduction first and thus, in a too brief stay, a visitor does not see where and why the reproduction failed—which is perhaps more instructive than seeing the successes. On one slope the spruce has succeeded, but look at the opposite side and we only find failure. Two Americans not long ago made this very mistake. They wanted to see a large variety of forests in a short time. They were usually driven through the best portions, took a few pictures from the carriage, and rushed off to the next place. Their antics lessened the German respect for American foresters. On the other hand, the "do a few places thoroughly" method is hardly the best, for the forest school graduate who has had a year or so of practical experience. Seldom is a stay of over three days profitable compared with going on to a new forest. Personally, I found European travel so instructive that I should strongly recommend even a short trip of two months, rather than a longer trip "when there is more time." With a sensible amount of time at one's disposal, say seven and a half months, I should advise four and a half months in Germany and three in France. This is taking for granted that a man knows something of both languages. Men who have visited France claim that the French methods are more adaptable to American conditions; that there is more natural reproduction and less planting. On the other hand, the German forest literature is so superior to the French that more time ought to be devoted to Germany.

Unless a man wishes to make a special study of management on a large scale and has plenty of time at his disposal, a trip to India specially for the study of forestry seems inadvisable. In a trip of five months at least two months of this must be spent in travel. An inexperienced man going into camp on his own hook runs considerable risk of catching enteric fever. In order to see the forests properly, it is necessary to provide a camping outfit and servants, so one man's expenses will amount to \$150 or over per month. With three men making the trip and travelling second class on the boat, the expenses might be reduced to less than \$100 per month, but it would entail some risk and hardship. In scientific lines I consider the United States already equal to, if not ahead of India. For men anticipating practical rather than scientific work, such a trip offers much. Certain common sense principles pervade Indian forestry, and these will be of lasting value and of direct application in the United States. On the purely practical side Indian forestry is at present preeminent. The financial working of the forests is closely scrutinized by the local governments. Possibly the financial importance of forestry has been made to take too prominent a place and has led in some cases to over-caring. Perhaps the quotation below, which was taken from a recent issue of an Indian newspaper, illustrates how the forests are regarded:

"However, while fully recognizing that the decrease in sales of timber and fuel in this particular division was 'unavoidable' and admitting that the various measures of improvement undertaken entailed considerable expense, one is inclined to regard a situation in which the net receipts of the department dropped by nearly 2½ lakhs 'as anything but satisfactory.' The Conservator and his subordinates are therefore once more earnestly exhorted to remember the fact that they are—timber merchants."

This idea pervades the administra-

tion and hence the practical side of every measure is most carefully weighed in the light of the expected financial results. By a trip to India one learns the ordering of forest business on a large scale; you see the best first protection in the world, practical silviculture, the regulation of grazing, the danger and abuses of over-felling, natural reproduction over large areas, you learn the results of certain kinds of large scale working plans—you learn many things, most of which have direct application in the United States. Opposed to these is the amount of time and money spent in travel, danger to health, and lack of available literature. It is almost impossible to secure copies of working plans for the reserves visited, or in fact any publications, similar to those which our government distributes free for educational purposes. Furthermore, I believe that after 1910 or thereabouts the same principles could be learned here in the United States. Japan is also a possibility for study. If her forest service is as good relatively as her other services, there is every reason to believe that much of value could be learned there.

The success of a European trip does not lie in the number and excellence of the notes recorded so much as in the broadening and rounding off of a forester's judgment. By seeing forests of all descriptions he begins to get the forestry eye as regards thinnings and reproduction, which it is now impossible to get in the United States. In making a hurried tour one is apt to think that he understands conditions before he really does. This is especially so as regards thinnings, and my personal experience leads me to recommend the actual marking of trees. It is surprising how simple thinnings seem and yet the number of mistakes one makes when personally executing them.

The notes taken will no doubt prove valuable and it is essential that they should be systematic. I should recommend the card catalogue method with

the following headings printed at the top of each 4 by 6-inch card: Country, Locality, Authority, Subject, Date. It is essential to know the authority, as in looking over a series of notes on the same subject, they will almost invariably contradict. Hence to properly weigh them one must know whether a forest guard or a forester is the authority. Photographs will prove ex-

pensive but are one of the best means of note taking—even if of small size.

To one who is pessimistic regarding American forestry, it will be cheering to see that even in the older countries errors are not unheard of—in fact, it might almost be said that forestry is made up of mistakes—and their correction!

THE EFFECT OF FOREST COVER UPON STREAM FLOW

PART I.

GENERAL FACTORS GOVERNING STREAM FLOW

BY

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IN the current discussion of the relation of forests to stream flow there is a danger of overestimating the influence of forest cover upon the character of a stream to the exclusion of other factors of equal or greater importance. It is a mistake to assume that the wooded or denuded condition of a watershed is of necessity the controlling factor in determining the behavior of the stream; that a forested stream is necessarily regular in flow and a deforested stream necessarily irregular. In any discussion of this subject, it must be recognized at the outset that forest cover is but one of a number of far-reaching factors whose combined influence produces a stream of a given character; and great care must be taken not to attribute to the presence or absence of forest cover upon a drainage basin results which may be due primarily to other causes.

Now there are two elements which enter into the flow of every stream:

(1) Surface run-off, or the water which on account of the steepness of the slopes, the impermeable character of the surface, or the saturated condition of the soil, does not sink into the

ground to any appreciable depth but flows rapidly off the surface and reaches the stream almost immediately after precipitation.

(2) Underground seepage, or the water which on account of the moderate slopes of the basin, the porous character of its surface, or the dryness of the exposed soil or vegetable litter, is able to sink into the ground to a greater or less depth instead of flowing at once over its surface. Such water may remain in the soil itself, seeping gradually into the channel of the stream. Or it may penetrate through the upper, permeable layers of rock, feeding springs and other underground sources of stream supply. In either event, the water which becomes underground seepage reaches the stream channel gradually and flows, often several months after its precipitation upon the basin.

The flow of every stream is made up in part of surface run-off, in part of underground seepage. Underground seepage, it is evident, forms the permanent, stable supply of a stream; surface run-off, its temporary, changeable supply. As the proportion

of surface run-off in the total supply of a stream increases, it becomes changeable, flashy, with alternating periods of very high and very low water. As the proportion of underground seepage in the total supply increases, the stream becomes stable, permanent, tending to maintain an even, uniform flow throughout the year. The relative proportion of surface run-off to underground seepage in the total supply of a stream is, therefore, the main factor in determining its character as regular or irregular, and its economic value for power, irrigation, or city supply. Any feature of the drainage basin which tends to convert precipitation into underground seepage helps by so much to make the stream regular and uniform in flow; and any feature which tends to shed precipitation as immediate, surface run-off, helps by so much to make the stream irregular and changeable in flow.

First cover is, then, but one of many complex and inter-related factors which influence the character of a stream. The more important of these factors may be briefly summarized as follows:

1. Precipitation, its amount, its character as rain or snow, and the evenness of its distribution throughout the year. Gentle rains, well distributed over many months, tend to maintain constant underground seepage and equable stream flow, no matter what the character of the drainage basin may be. Heavy seasonal storms,

on the other hand, especially when precipitation is confined to a few months in the year, flood the streams with surface run-off and cause changeable, intermittent flow. This condition of stream flow is illustrated

in the accompanying diagram of streams having distinct wet and dry seasons. The diagram shows a stream which flows only during the wet season, and which dries up during the dry season. The stream is shown as a line with arrows indicating the direction of flow. The flow is shown as being intermittent, with periods of flow followed by periods of no flow. The diagram is labeled "Intermittent flow" and "Dry season" and "Wet season".

uneven rainfall but can never wholly counteract it.

2. The topography of the drainage basin.

Rough topography, with steep, direct side slopes, tends of necessity to the rapid discharge of precipitation as surface run-off rather than its gradual absorption over the basin as underground seepage. Moderate topography, on the other hand, with gentle side slopes, retards the surface run-off and converts a larger proportion of the precipitation into underground seepage, the permanent, stable supply of stream flow. Streams of rough topography, moreover, have rapid fall and torrential current; those of moderate topography, slow fall and sluggish current, factors which affect directly the quickness with which a heavy precipitation upon the watershed is felt along the lower levels of the stream and its character as regular or changeable.

The simple or complex character of the topography is another important factor affecting the evenness of stream flow. Streams with few tributary basins, and those short, sharply defined, and direct in course, such as are found usually in the newer geological regions, rise and fall rapidly in response to variations in precipitation. Those, on the other hand, with many tributaries of the long, winding, indirect character common in the older, heavily eroded sections, discharge flood waters over a much longer period with less sudden and sharp variations in flow.

Finally, the presence or absence of lakes, ponds, or swamps in the drainage basin is a very important topographic feature in its bearing upon the behavior of the stream. Every such area acts as a natural reservoir, storing and holding flood waters, feeding them out gradually, and thus equalizing the flow of the stream throughout the year.

3. The geological character of the drainage basin. The character of the surface rock has much to do with the

immediate shedding of precipitated water or its absorption and storage as underground seepage. Hard surface rocks of dense texture, like the granites and gneisses, tend to shed rainfall at once as surface run-off. Softer rocks of porous texture, like limestone, favor the absorption of rainfall and its gradual transfer to the stream as underground seepage. The character of the mother rock, moreover, determines very largely the nature of the soil, its depth, porosity, its power of absorbing and retaining water, all factors of prime importance in their bearing upon the disposal of precipitated water as rapid surface discharge or gradual absorption to underground sources.

(4) The fourth of the important factors governing stream flow is the character of the vegetation upon the drainage basin, with special reference to the influence of forest cover. Forests have always been regarded as connected in some way with the protection and preservation of water supply. As this vague belief has been superseded by more exact investigation, certain definite influences have been attributed to forest cover in its bearing upon stream flow. Few of these influences can be said as yet to be clearly established, and many are combated by able authority. It will be attempted here simply to summarize the more important facts relating to each.

In the first place, it has been claimed that forest cover on a drainage basin actually increases the amount of water available for stream supply by retarding evaporation from the ground. This influence is attributed to the somewhat lower temperatures prevailing under forest cover and to the protective influence of the tree canopy and litter in insulating the soil from the sun's rays and thus checking the strength and directness of the evaporation force. Other reasons advanced are the high

relative humidity maintained in the atmosphere by forests through their shade and active transpiration from the leaf surface, and their influence in breaking up air currents and protecting the ground from the drying effect of wind. A series of German experiments, representing conditions both in the woods and in the open, shows that the total evaporation under forest cover averages but 44 per cent of the evaporation from unprotected soil.¹ Mr. Rauber, reckoning the amount of evaporation as the difference between the total annual precipitation upon a given basin and the estimated annual stream discharge from the same area, concludes that a difference of five or six inches in annual evaporation, or about 25 per cent, can be distinguished between a forested watershed like the upper Hudson and a deforested basin like the upper Genesee.²

On the other hand, the opposing claim is made that actually less water is available for stream supply on a forested than a deforested basin. This is due to the interception of 25 or 30 per cent of the rainfall by the foliage of a forest and its direct evaporation into the air, and to the large amounts of water consumed in the process of tree growth and transpiration. In this connection it is urged that variations in the amount of evaporation from drainage basins are due primarily to differences in temperature rather than to differences in soil conditions or forest cover. Mr. Vermorel cites a large number of eastern streams which have practically the same forest conditions but which show a range of eleven inches in the total annual evaporation. In nearly every instance increased evaporation accompanies higher mean annual and mean summer temperatures. In like manner, a number of eastern streams having a range in the total percentage of forested basin from 14 to 41 per cent show practically the same evaporation, the reason

¹cf. Bulletin 7, U. S. Bureau of Forestry, page 97.

²cf. Proceedings American Forestry Association, vol. xii, page 140.

assigned being similarity in prevailing temperatures.¹ Any rise in temperature quickens evaporation by lessening the humidity of the atmosphere and thus making possible the absorption of much larger quantities of moisture.

Whatever influence forest cover may exert in this direction is undoubtedly secondary to that of temperature, the primary factor in controlling evaporation. In the present uncertainty on this subject, no absolute conclusion as to the influence of forest cover can be drawn.

The second influence attributed to forest cover upon a drainage basin is the equalization of stream flow by transforming surface run-off into underground seepage. This is due in part to the mechanical obstruction of surface water by the leaves, branches, litter, roots and humus of the forest. Any such obstruction lengthens the time required by precipitated water to reach drainage channels and tends to convert a larger proportion into underground seepage. Underground seepage is increased, in the second place, by the marked capacity of forest litter and humus for absorbing and holding rain water. The porous, spongy character of humus not only enables it to absorb and hold two or three times as much water as the most absorbent soils, but it greatly increases the porosity and absorptive power of the mother soil with which it becomes mixed by gradual decomposition.

The equalizing influence of forest cover is exerted in another important respect by delaying the melting of snow and preventing, by its thick mulch of humus and litter, the freezing of the soil beneath during the winter months. It is claimed that the melting of snow upon open, exposed mountain slopes is often ten times as fast as upon forested slopes in the same region.² Moreover as the snow melts it stands

a much better chance of absorption and filtration to underground sources in the porous, unfrozen ground under the forest than on the hard, frozen soil of the exposed slopes. This protective influence is seen most clearly in the Rocky Mountain region which is subject to the warm Chinook winds of early spring.

The exact extent of the equalizing influence exerted by forest cover in each of these ways it is of course impossible to determine. Of their combined effect in equalizing stream flow much substantial evidence is cited. Such evidence is furnished by the lessened number and severity of floods upon forested as compared with denuded basins, by the greater premanency of flow from springs and other underground sources, and by the better sustained stream supply during months of little or no precipitation. As illustrating the usual difference between forested and deforested streams, Mr. Vermeule cites³ figures from the forested Passaic and the deforested Raritan of New Jersey, showing for the former a marked superiority in evenness of flow, less water proportionately being discharged immediately after heavy rains and more proportionately during dry months which follow. A forested basin thus shows a marked tendency to store flood water and discharge is more evenly and uniformly into the stream channel than a denuded basin in the same region. An interesting case from California is cited by Mr. Manson.⁴ Of two small tributaries of the Yuba River, of approximately the same drainage area, one is well covered with timber and brush, the other being largely denuded. Both streams were gaged in September, 1900 after three successive seasons of deficient rain. The forested stream showed a minimum run-off for the 120 days of low water of 113 second feet, while on

¹cf. Reports State Geologist of New Jersey, 1899, page 145; 1894, page 333.

²cf. Water Supply and Irrigation Papers, Division of Hydrography, U. S. G. S., No. 46, page 46.

³cf. Report State Geologist of New Jersey, 1899, page 162.

⁴cf. Bulletin 7. U. S. Bureau of Forestry, page 136.

the denuded basin the discharge during the same period was practically nothing.

This is by far the most far reaching and generally accepted influence of forests upon stream supply. Its extent and limits under varying conditions are still unknown. Its ability to counteract the effect of other unfavorable factors, such as steep topography and unevenly distributed rainfall, is still largely conjecture. We can, however, state with certainty that forests exert a powerful though ill defined influence in this direction.

A third distinct influence has been attributed to forest cover upon a drainage basin, namely, the checking of erosion upon the watershed and the consequent silting of stream channels, where the silting of storage reservoirs. Forest cover is supposed to check erosion by lessening the amount and velocity of surface run-off. Furthermore its mat of roots, humus, litter, moss, and undergrowth tends to hold the soil in place and protect it from the wearing action of such water as is discharged over or near the surface. Evidences of this influence are at hand in any mountain region of the United States. It is especially marked in the Southern Appalachians in the turbidity of streams which drain denuded basins, the choking of their channels with silt, and the often destructive deposits of mud and debris over level bottoms along their lower courses. This factor has a direct bearing upon the reclamation project in the west valley bottoms, and storage reservoirs. is often a very serious obstacle to the control of streams.

Not only does direct erosion of the exposed surface follow the removal of forest cover, but this loss of soil means ultimately the loss of the porous surface layer in which rainfall is absorbed and converted into underground seepage. Loss of forest cover and loss of soil go together. As the process of erosion goes on, impermeable strata are exposed, resulting in the rapid and destructive discharge of

precipitation as surface run-off. Forest cover on a drainage basin, therefore, not only checks directly the silting process so destructive to stream beds, valley farms, and reservoirs, but also by conserving the porous soil layer affects directly the regularity of stream flow.

Now it must be constantly borne in mind that these influences of forest cover, in their present status, must be classed as "attributed" rather than demonstrated or proved. Available material bearing upon them consists largely, up to the present, of theoretical discussion. Such experimental data as has been collected is fragmentary and inconclusive. Among investigators there are radical differences of opinion. At the same time we may consider the general equalizing effect of forest cover upon stream flow as well established in principle, though vague and ill defined in detail application.

Another point cannot be too strongly emphasized, that forest cover is but one of many factors in a drainage basin whose combined influence produces a stream of a given character. Great care is required not to attribute to forests influences which are due primarily to other factors; and likewise not to assume that forests exert no such influence when it simply may be counteracted by other and more powerful factors.

It is moreover impossible to make generalizations which can be applied to a wide range of natural conditions. This problem should rather be attacked piecemeal, by careful, detailed studies of individual streams and limited areas. Such studies should cover all the features of the drainage basin which may affect stream flow, precipitation, topography, geological conditions as well as forest cover, together with the behavior of the stream as shown by continuous discharge measurements. The various factors which govern stream flow are so closely interrelated in their action that it is impossible to assign to each its ex-

act influence in producing the final result. All the more necessary is it, therefore, before attributing any specific influence to some one factor like forest cover to consider the probable influence of all the other factors involved and their bearing upon the

one factor in question.

In a subsequent paper a brief account will be given of an investigation of two small drainage basins in eastern New York, in which the attempt was made to approach the question in this way.

A SUCCESSFUL ROOT PRUNING DEVICE

Now in use at the Government Nursery in Nebraska

BY

L. C. MILLER.

Forest Assistant, Bureau of Forestry.

BY a careful consideration of the best nursery practice to be followed out in the Bureau Nursery at Halsey, Neb., where there is a total seed bed area of two and one-half acres, with a capacity of two and one-half to three million seedlings annually, it is found that seedlings should be two years old before planting to their permanent sites in the sand-hills. It is also considered essential to produce this two year stock at a minimum cost per thousand in order to make the initial cost of establishing the permanent stand as economic as possible.

Transplanting increases the cost of seedling production so materially that it is not considered practical to transplant the vast quantity of seedlings grown in the Halsey Nursery, and hence it is considered advisable to rootprune all yearling stock and allow same to remain in seed bed for another year, at the end of which time the seedlings will have produced a vigorous root system equal, or nearly equal, to transplanted stock.

Until this spring, rootpruning has not been satisfactory, owing to the fact that no suitable device had been hit upon to do rapid, and at the same time, satisfactory work. Spades have been used, but with such a tool the



Fig. 1. Root pruner, as it appears when not in use.

lateral roots only can be cut, while the essential root to be pruned is the long taproot which is formed by most all the coniferous species.

In the San Gabriel nurseries, near Pasadena, California, a tool has been devised for pruning, which consists of a combined perpendicular and horizontal blade, to which a handle is attached, and this is pulled through the soil by one hand. This tool works very satisfactorily in a small nursery like the one near Pasadena, but it is

A. Scott, I succeeded in making a root pruner, which has proved highly satisfactory. This is shown in figures 1, 2 and 3.

The important feature of this tool is the cutting blade. This is one inch wide and one-eighth of an inch thick, and made from a first class piece of steel. It is U shaped, and the perpendicular sides are seven inches long, and the horizontal base is six inches long. This blade is riveted to substantial collars, which are made to



Fig 2. Root pruner in use, operated by two men.

entirely inadequate in a nursery like the one at Halsey, where millions of seedlings are to be pruned annually. The great necessity for some practical device for rootpruning was made apparent to me while inspecting the nursery and planting at Halsey in April, and I set to work to devise a tool for this purpose. With the assistance of Mr. F. W. Beslev, who had temporary charge of the Halsey Station during the absence of Mr. C.

fit on a Planet, Jr., garden hoe frame. This is a single wheel frame, and in order to have the wheel run between the rows of trees it was necessary to change it to the outer side. I am satisfied that this device attached to a double wheeled frame would make a more substantial tool. The cutting blade is filed to a keen edge, and kept so during the pruning operation. By having such a thin blade, and keeping it sharp, there is practically no resis-

tance offered in passing through the soil, and all roots are cut with out the usual injury done with a heavier tool. The blade for this tool was hammered from a hay rake tooth and proved to be just the quality of steel for the purpose.

Two men are required to do satisfactory pruning, one to guide the tool, and one to pull it through the soil. By cutting to a depth of six inches, it requires considerable power to operate, but it is found that by tying a rope on the frame, that one man can pull the pruner with considerable rapidity, but it requires considerable strength, and the process is by no means child's play, and a man who has rootpruned all day will feel as if he has earned his wages.

By the use of this tool, two men can prune from 100,000 to 150,000 in eight hours. This is extremely satisfactory speed when it is compared with other processes.

Immediately after pruning the beds are carefully raked over in order to level up the soil in the beds, which is more or less disturbed at the surface. This operation does not require a great deal of time, and is considered highly beneficial to the young seedlings.



Fig. 3. Raking beds after pruning has been done.

THE UP-BUILDING OF NEVADA

Third Anniversary of the Reclamation Act Celebrated
by the Formal Opening of the Truckee-Carson Project.

THE third anniversary of the passage of the Reclamation Act was fitly celebrated by formally turning water on 50,000 acres of land in Nevada, the first area to be benefitted by the provisions of this act.

The story of the construction of the Truckee-Carson project with its wonderful network of canals uniting the four principal drainage basins of the state, of the expenditure of \$9,000,000 and the ultimate intensive cultivation of more than 400,000

acres of land now barren and desolate, has been told again and again. Far up in the foothills of the snow-crowned Sierra Nevadas half a score of lakes will be utilized as reservoirs to store the flood and excess waters which flow down the mountain sides, and down in the valleys imposing dams will hold back millions of tons of water, turning rivers back upon themselves till great artificial lakes are formed, or diverting the water into channels more convenient for

the use of man. Lake beds will be drained and transformed into agricultural fields, and thousands of miles of ditches and laterals will distribute water over the land.

With the exception of a narrow fringe on the northern and southern borders of the state, Nevada lies in a basin from which water escapes only by evaporation. Humboldt River, rising in the mountains which divide Utah from Nevada, drains the entire northeastern portion of the state, carrying its waters several hundred miles to a wide basin near Lovelocks where

During all the idle centuries of the past these lands have been gathering richness in the silt washed down from the mountains, which has gradually filled up the valleys and prehistoric lakes, forming an alluvium of great depth and fertility.

The completed system of reservoirs in connection with the Truckee-Carson project will assure an annual water supply, even in low water seasons of 800,000 acre-feet, besides a portion of the streamflow which cannot be stored. As the country becomes more thickly settled and land



Job's Peak from Dressler Reservoir Site, California, showing one of the sources of water supply for the Truckee-Carson project.

it spreads out in a large lake and evaporates. The Truckee, Carson and Walker rivers created by the melting snows of the Sierra Nevada Mountains in California, flow east into Nevada where they, too, form lakes which have no outlets. The numerous mountain areas are subject to storms, giving rise to torrential streams which rush down the steep slopes and pile debris out upon the desert, into which the water sinks.

values increase, the underflow of streams and artesian water will add to the supply and increase the irrigable acreage. Hydrographers, who are thoroughly familiar with the water supply of the state, believe that water can be developed for the irrigation of fully 1,600,000 acres of land.

The marvelous manufacturing possibilities of the rivers in the shape of latent horse power cannot be estimated. The Truckee River alone in

its one hundred mile course falls 2,300 feet. The power which may be developed by regulating these streams will not only be valuable in connection with manufacturing interests, but can be transmitted electrically hundreds of miles, operating mines and electric roads, raising underground waters, and lighting cities and towns. A study of Nevada's water supply will be a revelation to those who know only that it is the driest state in the Union.

It was not by chance this section was singled out as the field for the

the pick for the hoe. So bountiful were the returns from the soil where water was applied, and so fabulous the prices which the hay and vegetables brought in the little mining towns of the silver region, that these farming communities grew and flourished.

Remote from the large centers of civilization, these dwellers of the desert developed a sturdy citizenship. Some of them have spent years of their lives and large sums of money in surveying and prospecting the resources of the state. Their patience



Lower Carson Reservoir Site, from Dam Site. (Truckee-Carson project.)

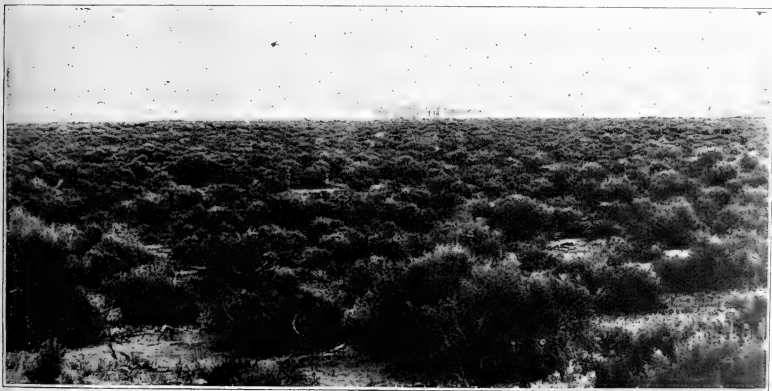
first demonstration of the practicability of the Reclamation Act. Nevada has guarded its treasures with an exterior so forbidding that the pioneer hurried past its doors. The discovery of placer deposits in its streams soon after the California excitement, was followed by a wave of gold-mad speculators which receded almost as suddenly as it came, but here and there in its wake tiny flecks of green marked the abode of the stranded miner, who forced by necessity, had exchanged

and persistence added to the thorough knowledge of Nevada's every possibility, which had been gained by L. H. Taylor in eight years of investigation for the Hydrographic Branch of the Geological Survey, resulted in the formulation of a comprehensive plan for the redemption of the state. From the countless sands of her sage brush deserts the empire which their fancy had builded is rising, and down through the ages these works will stand a monument to their foresight

and to the ingenuity of Supervising Engineer L. H. Taylor.

When the scheme for Nevada's resurrection was laid before the Department, the Secretary of the Interior tentatively approved the plan and set aside \$2,740,000 of the reclamation fund with which to initiate the great work. A portion of the project which would form a complete system was immediately laid out. It consisted of a canal thirty-one miles long to take the waters of the Truckee River over into Carson Valley, where a storage reservoir with a capacity of 286,000 acre-feet was designed. Four and a half miles below this reservoir site the combined waters of the Truckee

Owing to the wise provisions of the Reclamation Act, the colonization period under the Truckee-Carson project will differ from that which has taken place in any community on our continent up to the present time. Whenever there has been a great immigration movement for any reason, a host of speculators has rushed in, skimmed the cream and departed. The man who takes a forty or eighty-acre tract under this project must come to stay. He may not commute his entry after living a few months on the land, but must prepare the tract for cultivation, till the soil, paying his annual stipend of \$2.60 per acre for ten years before title passes from the



Scene in Mason Valley, near Wabuska, Nevada, showing character of land that is to be irrigated.

and Carson Rivers are to be led out upon the plains in two canals, one on each side of the river. The north side canal will have a capacity of 400 cubic feet per second and will irrigate approximately 40,000 acres of land, and the south side canal, with a capacity of 1,500 cubic feet per second, will supply water to about 160,000 acres. It is a portion of these lands which were formally opened to the public on June 17, and before another season the first payment from 50,000 acres will be replaced in the original investment.

government.

The eagerness with which the land is even now acquired by practical farmers, and the favor in which the first experiment of the government to reclaim its arid lands is regarded, is apparent in the vicinity of Wadsworth and Hazen. The desert is already dotted with buildings of prospective owners, and all along the railroad, at short intervals, new hamlets are rising. When once the great benefits of this initial work are fully demonstrated, Nevada will experience an immigration movement which has had

no parallel in the history of our country, a movement only limited by a capacity which cannot now be estimated.

As planned the Truckee-Carson project will supply water to 385,000 acres in excess of the land irrigated in Nevada at the present time. The average value of irrigated land in the United States is \$47 per acre; the acre to be irrigated by the Truckee-Carson project will therefore add \$18,195,000 to the taxable property of the state in land values alone. According to the census report of 1900 the average annual income from irrigated land is \$15 per acre. On this basis an income of \$5,775,000 per annum will be added to Nevada's agricultural wealth. The value of two crops will exceed the cost of the entire project by \$2,550,000. That this is a conservative estimate readily will be seen when it is remembered that irrigated potatoes in many portions of Carson Valley now give returns of \$150 per acre. Experiments by the Department of Agriculture show that the Truckee and Carson valleys are peculiarly fitted for the culture of sugar beets, hops will yield abundantly

and all the hardier fruits produce crops of remarkable flavor and size.

The mineral wealth of the state has hardly been prospected. With added transportation facilities and cheaper supplies, mines which are now abandoned will be worked with profit, new veins will be discovered, and markets for farm and manufactured products be increased.

Of the possibilities now lying latent in these sage brush plains no mind can prophesy. Water is the mystical wand which is to unlock this great storehouse of nature—the magician who wields it, the civil engineer, and where but a few years ago death mocked the daring pioneer and unknown graves dotted the plain, the life-giving water will be so regulated that neither drouth nor flood shall bring want to the settler; churches and schools will flourish, and the farmer will plant his crops with the certainty of bountiful harvests. From time immemorable irrigation has been synonymous with higher civilization. It creates loftier standards of living, makes prosperous communities and contented citizens.

THE WATER LEVELS OF THE GREAT LAKES.

THE water levels of the Great Lakes and the chagnes which have taken place during the last few decades are a matter of great public interest. Lake carriers commonly believe that the lake levels have lowered considerably and that the changes are attributable to the deepening of the connecting channels, and, perhaps, also to diversion through the Chicago Drainage Canal. The engineers of the U. S. Geological Survey have been investigating the in-flow to the Great Lakes, while the U. S. Lake Survey has measured the out-flow from the lakes. It is found that when the rain-fall on the lake surface is taken into

consideration there is a material loss or difference between the out-flow and the in-flow. This loss is attributed to evaporation from the lake surfaces. In order to determine this more definitely a set of instruments for measuring evaporation, wind velocity, and the temperature of the air and water, will be placed on Beaver Island in the northerly part of Lake Michigan. The instruments will be placed near the village of St. James and as they are near the center of the width of the lake they will be fully exposed to the wind and will give a record of the rain-fall, wind direction and velocity, and evaporation over the

lake itself, which could not be obtained from a similar station on the main land.

Beaver Island, where the station is to be placed, was settled by the Mormons in the middle of the last century and one of the Mormon leaders had himself crowned as king and maintained an absolute monarchy for a time, until he was deposed by the authorities of the State of Michigan; but, nothing daunted, he continued virtually his monarchy and had himself elected to all the important offices in the county, including that of member of the State Legislature. About 1870, the group of islands, of which Beaver Island is the most important, was divided between Charlevoix and Leland Counties, and the self-styled monarch was finally forced to abdicate and was later murdered by one of his confederates.

The evaporation record at St. James is kept in connection with the Signal Display Station of the U. S. Weather Bureau, and is under the direction of Robt. E. Horton, district hydrographer, of Utica, New York.

What seems to be a newly discovered cause for the lowering of the levels of the Great Lakes, which is commonly believed to have taken place during the last half of the century, is brought forward in an investigation by Mr. Robt. E. Horton, of the U. S. Geological Survey. It is well known that Michigan was at one time almost completely covered with heavy forests. These have gradually been

cut away and the land cleared for agriculture. In early days many marshes existed. Many of these were the result of beaver dams blocking the passages of the streams. These dams have been cleared out and drainage channels aggregating thousands of miles in length have been excavated. Mr. Horton has collected statistics showing the extent of deforestation, drainage and cultivation of land, and its progress from year to year, over the State of Michigan. It is found that the changes which have taken place have been sufficient according to the estimates of different authorities to decrease the average flow in the streams from five to twenty per cent. per year. It is possible that in some sections of the state the cutting off of pine timber has actually increased instead of decreasing the annual flow of the streams available for water power and other purposes. Balancing the different elements it has been found that a decrease in the depth of rain-fall, which runs off in the streams, of at least one-inch per year, has probably taken place over the State of Michigan in the past fifty years. The importance of this fact will at once be seen when it is understood that a decrease of one-inch in the run-off of the stream's tributary to the lakes means an average lowering of the lake levels from Lake Erie to Lake Michigan and their connecting channels of at least seven inches, or over half a foot.



THE RECLAMATION SERVICE

New Projects in View---Work Progressing Rapidly on those Already Started

Development of Klamath Region.

Crater Lake, in Klamath County, Oregon, is one of the wonders of the wonderful West. This strangely beautiful body of water is included in a National Park, and though at present it is not easily accessible, it will prove a mecca for many of the thousands of Eastern people who will visit the Lewis and Clark Exposition at Portland this summer.

South of Crater Lake is the great Klamath Country, including parts of Klamath County, Oregon, and Siskiyou and Modoc counties, California, a land o' lakes and a territory of great possibilities. The United States Reclamation Service has found this section so promising that its engineers are planning a drainage and irrigation system to cover about 250,000 acres of excellent land.

Prominent features in the topography of this country are three large navigable lakes, Upper Klamath, having an elevation of 4,142 feet, Lower Klamath, with an elevation of 4,086 feet, and Tule of Rhett Lake with an elevation of 4,056 feet. From Clear Lake, a smaller body of water having an elevation of 4,533 feet, Lost River, a considerable stream, wanders aimlessly through a chain of fertile valleys until it empties its waters into Tule Lake.

It is a unique feature of the Klamath Reclamation project that of the 250,000 acres to be irrigated, at least half is now constantly under water of a depth varying from one to fifteen feet. In all irrigation works undertaken by the Reclamation Service, drainage accompanies irrigation as a vitally necessary adjunct, but for half the lands in this project drainage must, for two or three years, precede irrigation. It is proposed to drain off

all the waters of Lower Klamath Lake and to uncover half the lands in Tule Lake, the Federal Congress and the Legislatures of Oregon and California having given the necessary permission to the Reclamation Service. The two states have ceded to the National Government all lands in the lake beds, and these lands, with the exception of the acreage now held in private ownership, will be subject to homestead entry when thoroughly drained and ready for cultivation.

A greater part of the area, 190,000 acres, under the Klamath project, will be irrigated with water drawn from Upper Klamath Lake, a natural and inexhaustible reservoir. No storage dam is required here, the lake having a sufficiently higher elevation than the lands to be watered. About 60,000 acres will be watered from Clear Lake, in California, or from Horsefly reservoir situated in Oregon.

Of the now dry lands under the project only a few thousand acres are public lands. The greater part of the lands in private ownership is held in large tracts, and, under the provisions of the Reclamation Act, those lands must be sold in small lots, as one person can purchase water for no more than 160 acres. The Klamath Water Users' Association, a corporation of land owners with a capital stock of \$3,000,000, has organized to cooperate with and assist the Reclamation Service. The office of the association is at Klamath Falls, Oregon, the county seat of Klamath County.

The Klamath Country is now without immediate railroad connection, but two companies have given assurance that they will begin immediate construction of railroads to connect Klamath Falls with the Southern Pacific



line running between San Francisco and Portland.

The land owners have found it necessary, owing to the lack of transportation facilities, to confine themselves to the cattle industry and the cultivation of hay. Alfalfa yields from four to five tons per acre. The lands produce heavy crops of grain, apples, peas, plums, cherries, and peaches, and the smaller fruits are successfully grown. Sugar beets raised as an experiment, show a high percentage of sugar. Most of the vegetables, and especially onions and potatoes, yield bountifully. The streams and lakes abound with trout, while ducks of every kind and geese tempt the huntsman.

Progress on Belle Fourche Project.

Construction work on the Belle Fourche project has commenced in earnest, two camps having been established, one at the head of the inlet canal for work on that canal, and one at Owl Creek reservoir site for work on the dam and the first section of the outlet canal.

Bids have been requested for the construction of a double circuit telephone line connecting each of these headquarter camps with the town of Belle Fourche. It is proposed to drill an artesian well at each camp, as the surface water is unfit for domestic use during the greater part of the year. The buildings are so located and constructed that they can be utilized by the gate-keepers after the project is completed.

The successful bidder for the construction of the inlet canal has begun work and 1,000 barrels of cement have been received and tested. Final location of six and one-half miles of canal has been completed, and considerable surveying and other preliminary work accomplished.

The party situated at the dam site has made a general reconnaissance of the area around the dam and about 120 holes have been bored to obtain information as to the location of material and amount of same. One gravel bed containing 15,000 cubic

yards of gravel was located for use in construction work.

Stream gaging for the season was begun on April 1st, twelve stations visited and checked, gages repaired and one cable station established. New stations were established—one on Hot Creek and one on Beaver Creek.

Making a New Town in Idaho.

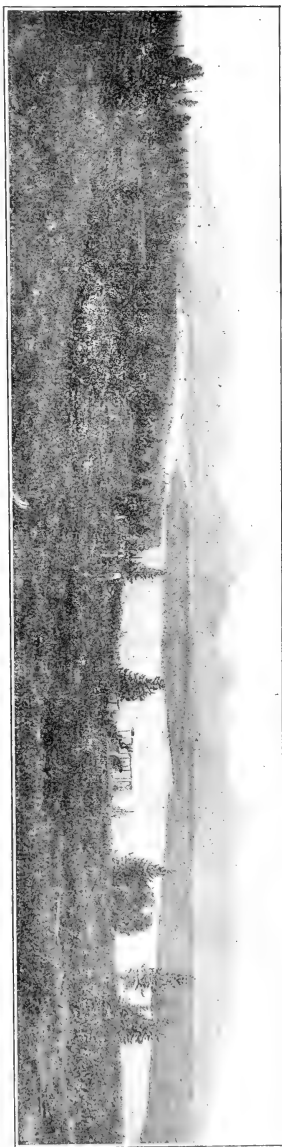
Resolutions have been passed by the State Land Board, of Idaho, pledging the coöperation of the state in the matter of laying out and disposing of lots in the new town of Heyburn, on the tract included in the Minidoka irrigation project.

At the suggestion of Governor Gooding the subdivisions were extended half a mile farther west than in the original design. The railroad siding of the Oregon Short Line Railway has been constructed and the depot site located.

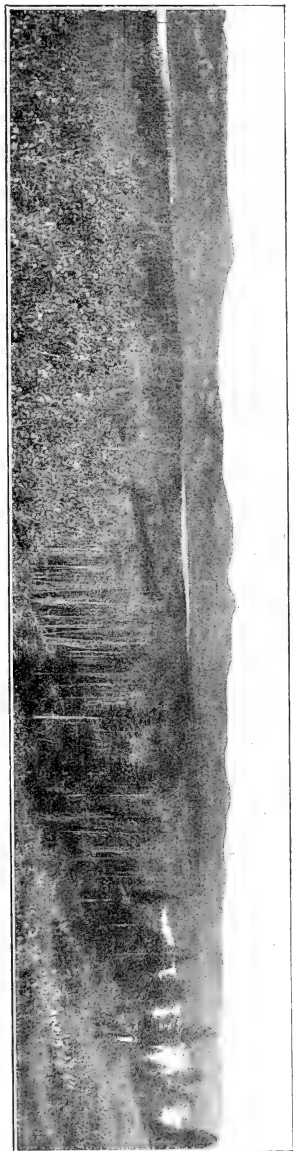
The town was named in honor of Senator Heyburn on account of his deep interest in the Idaho projects in general and the establishment of this municipality in particular.

It is probable that the Secretary of the Interior will place certain lots in both the government reserve and the state subdivision on the market in the near future for this purpose. Practically all of the land on the north side is now taken and the people are living on their claims. Trains are running as far as the river and a large construction crew is located at the town site. Several business men are desirous of locating at this point and many private individuals have signified their wish to buy lots for residence purposes.

A committee appointed by a mass meeting of citizens for the purpose has drawn up resolutions asking for the immediate opening of the town-sites. It is recited that the settlers will be subject to great hardship, resulting from their inability to obtain supplies if the town is not opened soon, and that business men who desire to locate will go to other points. The work which the settlers might



Jackson and Emma Matilda Lakes, Wyoming.



Two Ocean and Emma Matilda Lakes, Wyoming.

obtain incident to building up the town would also be of great assistance in helping them until such time as water can be furnished.

It is probable that as soon as the necessary preliminaries, such as appraising the land, can be completed, the Department will proceed with the disposition of such areas as it is deemed advisable to throw open at the present time.

State Irrigation Under National Supervision.

In certain sections of the west steps are being taken toward inaugurating the plan suggested at the irrigation congress at El Paso, Texas, by the following declaration:

"We would not have the west depend alone upon national aid for the development of its resources, and urge the several Western States and Territories to adopt legislation providing for the formation of irrigation districts, which shall be able to raise funds by the sale of bonds, said districts to be organized only upon approval by the Secretary of the Interior, who shall employ the engineers of the Reclamation Service in the construction of district irrigation works. By this means the reclamation fund will be supplemented to the extent of millions of dollars by every state and territory, while the benefits of national administration will be vastly extended. We commend this subject to the earnest attention of the Legislatures of our Western States and Territories."

If legislation by the several arid states and by Congress is enacted to authorize and regulate such operations, there is no doubt that great benefits would accrue to the arid region. This legislation would be in line with the real intent of the Reclamation Law, which was enacted for the purpose of accomplishing by Federal aid what private capital or the states themselves could not effectually do.

The limited fund now available for reclamation purposes as compared with the enormous irrigation possi-

bilities awaiting development under it, makes it highly improbable that many otherwise feasible projects will be undertaken for several years.

The suggestion is made that the Secretary of the Interior, through the engineers of the Reclamation Service, should make the necessary examinations and plans for projects to be constructed by the irrigation districts; that contracts for the work should be let through the Secretary of the Interior, and that the funds be supplied by the sale of irrigation district bonds, the same to be expended by the Secretary of the Interior.

It is believed that legislation of this kind could be drawn so as to properly conserve the interests of the government and protect the Reclamation fund, and that it would be of great benefit in the development of the arid region.

Petition from Smith River Valley, Montana.

A petition has been received by the Director of the U. S. Geological Survey from residents of Smith River Valley, Meagher County, Montana, asking that a reservoir be constructed by the Reclamation Service on the North Fork of Smith River for the purpose of irrigating lands in that valley.

The petitioners set forth the excellent character of the land and its possibilities under careful cultivation when supplied with an adequate water supply, and the advantage which will accrue to the residents in the valley if the reservoir is constructed.

An investigation of the conditions will be made at the earliest opportunity found for doing so without retarding the work for which plans have been made and which has reached a somewhat advanced stage.

Forming a Water Users' Association in North Dakota.

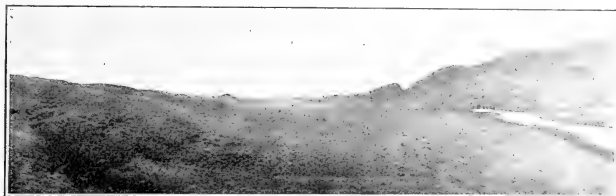
Preliminary work toward the formation of a water users association under the Bismark project, North Dakota, is under way, and the meeting

of citizens and land owners held May 15, at Bismark, was well attended.

There is a great increase of sentiment in favor of the project among the land owners. Many tracts of land within the area proposed to be irrigated are owned by non-residents or by companies, but these interests are gradually coming in and many business men are purchasing lands, thereby becoming eligible to membership in the association. It is believed now that the association will be incorporated in a short time and the required

years, and by pumping in dry years. The timbered areas on the lower bottom along the river bank will also be examined to determine how much of this area should be left out of the project on account of the value of the timber or for the sake of protecting the bank from being washed away.

If, however, the land owners under the Bismarck project do not take the required steps to cooperate with the government the work will be allowed to drop for the present and the feasi-



Bench Lands, Okanogan River, Washington.



Brown Lake Reservoir Site, Washington.

percentage of land owners will have been signed up.

The preliminary work on the Fort Lincoln project will be completed soon, and preliminary plans and estimates prepared. A field party has been directed to make surveys of the proposed reservoir site on Apple Creek in order that this feature of the Bismarck project may be better defined. It is possible that two or three thousand acres may be added to the original area by this means, most of which could be supplied by gravity in wet

bility of the Fort Lincoln project will be considered.

Planning a Washington Project.

Observations of water supply and related investigations on the Okanogan project, Washington, are being pushed by the district engineers, to the end that detailed estimates of cost may be presented to the land owners.

The irrigable lands consist of 15,000 acres of varying quality, lying in a series of benches between the Okanogan River and the hills surround-

ing the Okanogan valley between the towns of Alma and Riverside. The water supply is believed to be insufficient for the proper irrigation of more than 10,000 acres, 1,500 acres of which are already irrigated.

The limited area of the tract and its location in the heart of an extensive range country, which would be dependent upon it for its winter feed, would insure a profitable and permanent market for forage. The lands are also well adapted to the production of deciduous fruits and nuts, and when cultivated in these products would yield large returns. Lands near Wenatchee, of similar character, with adequate water supply, are worth from \$150 to \$200 per acre.

The climate is mild, but some years the exceptional depth of snow prevents the feeding of stock on the range. The growing season lasts about six months and light crops of hay or potatoes can be raised without irrigation. The present value of non-irrigated land is about \$5 per acre, when irrigated, from \$40 to \$100. Three crops of alfalfa producing from four to six tons per acre are harvested and temperate fruits, small fruits, vegetables and wheat are raised. The fuel supply is practically unlimited on account of the heavy growth of timber in the hills and mountains.

Lumber for building purposes can be obtained at reasonable prices—\$8 to \$15 per thousand, board measure, at the mills, which are located at various points for convenient hauling. Good markets are found in Seattle, Tacoma, Spokane and Alaska.

On account of the possibilities for high development it is believed that the farm units will be small.

In case the investigations now in progress do not develop a material increase in the present estimates of cost the construction of the project will rest largely with the land owners and their readiness to comply with the required terms.

Studying Quality of California Waters.

The California Legislature, during its last session appropriated a sum of

money to be used in coöperation with the U. S. Geological Survey for the purpose of determining the economic qualities of the waters of the state, and a contract has just been executed by which the work shall be carried on. It provides, in brief, for the determination of the quality of the natural waters in the state of California and their adaptability for use for domestic and industrial purposes, the seasonal variation in composition, and the damage which they have sustained by reason of pollution. It is also provided that this investigation shall be under the joint direction of the Director of the U. S. Geological Survey and the Secretary of the State Board of Examiners.

The practical results of this work will be to provide the residents of the state of California with information concerning the adaptability of the various water supplies of the state for use in industrial and domestic purposes. It is a well recognized fact that the quality of water in any region determines in a large measure the industrial development of that region, and it has frequently been observed that an industry will locate at points where there is available water of a quality specially favorable to that particular industry. The water in a certain area, for example, may be of a quality favorable for use in a distillery when it could in no wise be utilized in a soap factory. Therefore it is necessary to secure the facts in relation to the quality of water supplies of a state in order that the highest industrial development may be secured.

In addition to the industrial features there are present in California peculiar conditions with reference to sources of water for domestic purposes. It has been noted in some cases that certain supplies during ordinary seasons are too hard or contain too much salt to be used with satisfaction for household purposes. Water from these same sources during times of flood is, however, of good quality. This suggests the possibility of conserving flood waters for domes-

tice use in places where it has heretofore been believed impossible to secure good supplies. This belief arose from lack of knowledge of the actual conditions. Therefore the proposed study of the seasonal variations of the quality of water in the principal streams will be of immense advantage to the many municipalities in the State of California in which it has up to this time been impossible to secure water supplies of satisfactory quality.

The investigation under the cooperative agreement will commence on or about July 1, and the greater part of the work will be performed in the laboratory of the U. S. Geological Survey at Berkeley, California.

The Sacramento Valley.

A committee appointed for the purpose by the Board of Supervisors, Red Bluff, California, has forwarded resolutions relating to the reclamation of lands in Sacramento Valley to Consulting Engineer J. B. Lippincott, of the Reclamation Service, at Los Angeles, California.

The committee believes that the construction and completion of proper dams and reservoirs upon the Sacramento River at points above Red Bluff, and upon other streams, tributary thereto, would improve the navigability of the river, and in connection with ditches to be built for irrigation purposes, would result in making far more productive a large portion of the lands in that part of the state, and be of great permanent benefit to all lands in Sacramento Valley, and petitions the government to enter upon the construction of such works as soon as practicable. The following resolution was unanimously adopted:

"Resolved; That it is the sense of this meeting that the Sacramento Valley Development Association make a strong effort to interest the entire Sacramento Valley in the irrigation of the semi-arid section thereof, also in the reclamation of the flooded districts thereof; that meetings be called and arranged for throughout the entire district interested, and such meetings reported back to the Development As-

sociation, to the end that concerted action may be taken for the earnest presentation of the matter to the U. S. Government at an early day."

Since 1895 the Hydrographic Branch of the Geological Survey has kept daily records of the flow of the Sacramento River, and the data obtained by observations of the available water supply, extending through a term of years, is of great value to any scheme of reclamation. Detailed studies are being made of the various streams of Sacramento Valley, reservoir sites are being surveyed and gaging stations established.

About four years ago the Reclamation Service, through the Water and Forest Association, expressed itself as anxious to take up a comprehensive study of the entire situation. The state cooperated in this movement, and detailed surveys of the entire floor of the Sacramento Valley have been made, as well as careful studies of the forestry conditions in its drainage basin, it being well understood that these conditions vitally affect the character of the low water and flood discharge in the streams. Extended studies of the engineering features of the proposition have also been made.

Sacramento Valley offers one of the most extensive and intricate problems in development in arid America, and the progress of the investigations is being carefully watched by the Board of Consulting Engineers. It is probable that special acts of Congress will be required for an adequate handling of the situation, both in relation to navigation and overflow, and possibly of state cooperation.

Owing to the magnitude of the problem and the numerous and heavy demands upon the resources of the Reclamation Service, it will be impossible to work out this scheme in a hurried manner. It is believed that if the organization of the committee is continued and the people prepared to cooperate with the government when the time for action arrives, one by one the various units of the enterprise will be worked out, till this greatest problem of the arid country

shall have been solved in a harmonious manner and according to a preconceived plan.

Personal Notes.

Mr. W. S. Coulter, of Boston, was recently appointed assistant engineer in the Reclamation Service, and has gone to Fort Laramie, Wyoming, where he will report to Mr. John E. Field, engineer in charge of the North Platte project.

Walter C. Wilson was recently appointed an engineering aid, and has gone to Minidoka, Idaho, to report to F. C. Horn, constructing engineer. Mr. Wilson, who is a native of Indiana and attended Earlham College, at Richmond, that State, is a graduate student of Sheffield Scientific School, Yale University. He has been engaged in surveying for the Pennsylvania Railroad Company, and as draftsman for the Louisiana Purchase Exposition.

H. M. Morse, engineering aid in Reclamation Service, has been transferred to Montana, where he will be engaged upon hydrographic work on the Milk River project under the supervision of Mr. C. C. Babb. Mr. Morse graduated from Dartmouth College with the degree of B. S., and from the Thayer School of Civil Engineering, C. E. He has served in the capacity of assistant engineer on the water works at Needham, Falmouth, and Lexington, Mass.

In the plans of the United States Geological Survey for the coming year, Mr. N. H. Darton, Chief of the Bureau of Western Hydrology, is arranging to make a thorough investigation of the artesian water supply in the region around Great Falls.

In connection with the work of the Milk River project the following assignments have been made to Mr. Cyrus C. Babb, engineer in charge; L. E. Grandke, engineer; A. H. Perkins, engineer; C. T. Prall, assistant engineer; L. R. Stockman, assistant engineer; Arthur T. Nelson, civil engineer; Joseph B. S. McIntosh, assistant engineer; M. A. Woodell, stenographic field assistant; E. J. Fisher, engineering aid; J. S. Bingham, engineering aid; J. H. Sloan, engineering aid; H. M. Morse, engineering aid; A. M. Grain, engineering aid.

Mr. George A. Hammond, superintendent of diamond drilling, U. S. Reclamation Service, has been directed to make plans for boring for foundation at Gore Canyon, in Colorado, at what is known as the Kremmling reservoir site.

Ben F. Dupuy, has been appointed engineering aid and ordered to report to Supervising Engineer L. H. Taylor, Hazen, Nevada, for work in connection with the Truckee-Carson project. Mr. Dupuy is a graduate of the Ohio State University with the degree of C. E., and has had considerable experience, especially in connection with railroads.

The Secretary of the Interior has executed the contract and approved the bond of T. P'Keefe & Company, of Oklahoma City, Oklahoma, for the erection of an eight-room school house in the city of Hobart, Oklahoma.

The Stevens-Sweetman Mercantile Company, Mondak, Montana, has been awarded the contract for furnishing the material for building required under the Fort Buford project, their bid, \$2,126.89, being the lowest.



THE NEW MONTANA

Tremendous Agricultural Development Possible
By Means of Government Reclamation Work

MONTANA'S contributions to the wealth of the nation have come mainly from the hearts of her mountains or the sands of her countless streams. While these storehouses of riches show little sign of exhaustion, a greater resource, and one which will in future yield even larger values, is just beginning to be developed. This resource is a soil so deep, black, and fertile that industrious husbandry can never exhaust its productivity. Senator Paris Gibson, an authority on agriculture, who for thirty years has studied the resources of his State, says: "Montana has potentialities in agriculture awaiting the scientific farmer which are destined, when developed, to place the State in the forefront as a producer of farm products."

With its vast area, its varied topography, its countless streams which head in regions of everlasting snow, or spring full grown from the largest glaciers in the world, its sheltered valleys and broad level mesas, Montana offers the most alluring field to which the engineers of the Reclamation Service have given their attention.

Deep in the hearts of its mountains the miner's pick is breaking down the precious metals which contribute millions annually to the world's wealth. In the solitudes of its vast forests the woodman's axe is hewing down the giant timbers, and now the silence of centuries is being broken in the desert and desolate valleys are soon to become the centers of populous and prosperous communities.

The man with the plow follows the ditch engineer, and ere the mind can grasp the thought the desert begins to fade and green fields and blossoming orchards spring into view.

Irrigation has its limits, but they are not yet apparent in Montana. While in most of the arid inter-moun-

tain States the limits of irrigation mark the limits of agricultural development, in Montana this is not true, for agriculture in many sections of that State does not depend upon irrigation. In fact, the largest yields of wheat, oats, and rye are produced on unirrigated land. Senator Gibson's ranch affords a most striking illustration of what can be done in parts of Montana without irrigation. This ranch is situated only a few miles from Great Falls, and is in a section which the Land Office was very loath to regard as anything but desert and worthless, yet the Senator secures 40 bushels of wheat per acre, 5 tons of alfalfa, and 60 bushels of heavy oats, and he has no ditches or artificial water supply. Yields of 60 bushels of wheat and 105 bushels of oats per acre are reported from adjoining ranches.

Montana's claims to recognition as one of the future great farming States are easily shown when comparisons are made between its average yields of various products and those of well known agricultural States. The Department of Agriculture furnishes the following table:

State.	Wheat.		Rye.		Bar- ley.		Oats.		Hay.		Pota- toes.		Flax.	
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Tons.	Bu.	Bu.	Bu.	Bu.	Bu.
Montana....	28	24	40	46	2.08	176	14							
Iowa.....	12	16	23	24	1.78	56	10							
Missouri....	8	12	18	22	1.57	66	6							
Kansas.....	14	16	31	26	1.58	88	6							
The Dakotas.	13	18	26	33	1.31	86	9							
Minnesota...	12	18	25	32	1.84	64	9							
New York...	17	15	26	34	1.26	89	..							
Michigan....	15	15	25	30	1.37	78	..							
Nebraska....	15	14	26	29	1.68	64	10							
Wisconsin...	15	16	27	32	1.89	58	12							
Pennsylvania	15	15	21	28	1.27	91	..							
United States	12.3	15	26	28	1.54	84	8							

In average yields of wheat, rye, barley and flax, Montana leads every State in the Union; in oats and potatoes, only one State is ahead of it, and in hay the yields are heavier than those of any Eastern State. The aver-

age wheat and potato yields are 28 and 176 bushels per acre, respectively, or more than double the average for the United States. As a matter of fact, many Montana farms run 40 and 50 bushels of wheat and 350 and 400 bushels of potatoes to the acre.

When Senator Gibson first moved into Montana agriculture was unheard of, nor was it ever thought there could be such a thing in that country. Last year Cascade county in which he resides, took the prize at the State Agricultural Fair with an exhibit which might have won the prize if it had been in competition with the entire United States. The State Fair at Helena last year contained one of the most wonderful and varied exhibits of grains, forage crops, vegetables, and fruits which has been witnessed in any State.

The agricultural resources of Montana have hardly been prospected, and the magnificent showing made at the county and State expositions is but an earnest of what is to follow. The vast bench lands of the State aggregate millions of acres, with soil of inky blackness, the grist of the mountains, capable of producing great crops. Irrigation carried on by private enterprise has brought under a high state of cultivation more than a million acres. The 10,000 farmers in the State who are artificially watering their crops have invested nearly \$6,000,000 in ditches traversing nearly 9,000 miles of desert.

The National Government, working under the provisions of the Reclamation Act of June 17, 1902, has already projected a plan of reclamation in the State which, in the near future, promises to bring under intensive cultivation an area of desert almost equal to the present irrigated acreage.

MONTANA'S WATER SUPPLY.

The great rivers of the Northwest which make up the flow of the Missouri and the Columbia come out of the Rocky Mountains in this State, and furnish a water supply sufficient for an empire. The Government engi-

neers are working on big irrigation schemes on the Milk River, Yellowstone, the Sun, Marias, Madison, and other streams, the completion of which will add tens of millions of dollars annually to the value of farm products of the State. Four of these projects are already decided upon, and will cost between five and six million dollars.

SUN RIVER PROJECT.

One of the most promising of these which Senator Gibson has been working to further, is on the Sun River, an important tributary of the Missouri, which empties into that river at Great Falls. Flowing out of steep canyons cut deeply into the main chain of the Rockies, where grey granite and white limestone pierce the clouds, and eastward from the continental divide, the Sun River rushes downward, a crystal icy torrent, leaping over precipitous heights and surging through narrow and impassable gorges, to join the Missouri.

Uncle Sam's engineers propose to bridle and harness this wild stream and make it do plebian duty on the agricultural plains and valleys which it crosses. Three hundred thousand acres with fertile desert loam await only the touch of the waters of this stream to spring into green, instinct with life and productiveness. At one point in its course, where this river cuts deep through the heart of the mountains, it dashes through a narrow gorge, a mere slit with walls a thousand feet high and but four feet apart at the bottom. Here it is proposed to erect a diversion dam which will be 125 feet high, 4 feet wide at the base, and only 15 feet wide on top. The water held in check by this dam will be diverted through a tunnel 500 feet or more in length, piercing the hard limestone and connecting with a distributory system which will carry it out upon a compact of land miles and miles in extent.

A COW PUNCHER ENGINEER.

The genius of this scheme is Samuel B. Robbins, a swarthy giant, engineer

of the U. S. Reclamation Service, six feet two in his stockings, a graduate of Yale, but for 18 years interested in Montana. He is well equipped by long experience in actual construction in this country to direct the work necessary to subdue the forces of nature found in the Sun River project. With a wiry cayuse pony under him, trained by experience to the usages of the plains, Sam Robbins is independent of railways. For the past decade the Sun River irrigation project has been his hobby, his day dream, but not until the Government came into the field was there a possibility of carrying it to completion.

POSSIBILITIES OF SUN RIVER VALLEY.

Basing the capacity of the Sun River

er lands upon the average census farm returns for Montana, the Sun River Valley, when reclaimed, should yield of rough crops nearly 10,000,000 bushels of wheat, or 600,000 tons of alfalfa, worth this year in Great Falls \$15 a ton.

The production of vegetables, sugar beets, or fruit, will be immense. Once brought under a perfect system of irrigation as the one the Government proposes, this valley will support a prosperous farm population of 15,000 and make a splendid city of Great Falls, whose marvelous manufacturing possibilities in the shape of 340,000 latent horse power racing down the falls of the Missouri are already attracting attention.

A SUGGESTION REGARDING THE NATIONAL FOREST RESERVES

Editor of FORESTRY AND IRRIGATION:

Dear Sir:

THE recent transfer of the administration of the national forest reserves from the General Land Office to the Bureau of Forestry opens such broad and varied opportunities for forest work, that we are inclined already to look into the future and picture to ourselves some of the important changes that are destined to take place within those areas. We may naturally expect to see the principles of silviculture and general protective and economic forestry applied more extensively and effectively than heretofore, while the history of the Bureau gives assurance that local interests and practical ideas will receive every consideration in the management of the reserves. In thinking over the future development thus promised by the service of the Bureau, I have been impressed especially with the intricacy of the silvicultural conditions. It has occurred to me in this

connection that certain areas within the reserves might be utilized in a special way to simplify silvicultural problems. Believing that the suggestion which I have to make may possibly be of interest to readers of this magazine, I will, with your permission, outline it in the following paragraph:

Whoever has studied the artificial forests of Germany, France, and other European countries in which systems of forestry have become firmly established, must have noticed the restrictions there placed upon the free play of nature's forces and the consequent loss in suggestiveness to the student of forest life. Where trees are commanded to live in mixture or separated according to species, to grow densely or openly, to disappear at a certain age; where, also, undergrowth and surface-growth are encouraged or excluded, as the case may be, and even the nature of the soil is gradually brought into subjection, the language of the forest becomes less and less varied in its expression. But where nature is al-

lowed perfect freedom an endless variety of idioms, so **to speak**, is found, and, by the same analogy, changing moods and tenses give expression to the character of the forest and reveal its capabilities.

It is true that the artificial forest sometimes teaches us silvical truths that are hidden or unobservable in the natural forest. It is also true that in our own forests, where the accidents of civilization have often interfered rudely and suddenly with a natural development, new and valuable information is sometimes presented in the most emphatic and striking manner. But such lessons have a restricted meaning when compared with the subtle teachings of the purely virgin forest, because they are based on sudden and drastic changes, which interfere with the operation of other forces and which it is often undesirable or impossible to repeat in practice. On the other hand, the life history of the virgin forest is more logical and connected and, although in many things inscrutable and difficult of interpretation, it yields the richest suggestions to careful investigation.

Such considerations have made it appear to me that it might be of much practical value in the development of future systems of forest management, if selected areas of purely virgin forest could be maintained in that condition for purposes of study and comparison. These would, in addition, be of general scientific and historic interest and would be most welcome to students of nature, as well as to lovers of landscape and to all those who appreciate the quiet, wild places of the earth.

It may possibly be objected that we already possess extensive reserves of this kind in our national parks; but the purpose of these is entirely different. Most of the national parks were established to preserve some natural wonder of geologic or botanic interest, or to commemorate some important event in our national history. They do not illustrate with any completeness

the striking relations between forest growth and geologic formation, altitude, latitude, rainfall, and other geographic and climatic factors. Or it may be thought that the selection of truly representative areas for different regions would be difficult, if not impossible, on account of the rare occurrence of purely virgin tracts, entirely unchanged by fire, grazing, or other human interferences. To this it may be answered that absolutely primitive conditions would hardly be necessary; it would be sufficient for practical purposes if the reserved areas clearly represented distinct types of forest and a reasonably close approximation to virgin conditions. By carefully protecting such areas they might soon be led back to a perfectly natural state.

It is not my purpose to enter into details here regarding the necessary number or the proper sizes of these local or regional forest type reservations, but it is evident that they should be so chosen and delimited as to constitute in each case an individual and unified whole; as, for example, a distinct section of some valley, a minor watershed, or a small basin. They should also be so situated as to lend themselves to some practical, efficient system of protection.

If there is practical value in the foregoing suggestion it would seem desirable to make an early segregation of such tracts; not because there is an immediate necessity for them, but because propositions of this nature, if they do not receive early attention, are less likely to be considered in the urgency of later work.

Let me call attention to the æsthetic value that would belong to such reservations and the interest that they would have for future generations as examples of the genuine, unaltered expressions of nature. In them might be preserved the expressive form of many kinds of trees, the manifold beauties of foliage and branches, the characteristic groupings in the natural forest, and its peculiar lights and shadows. Large old trees, striking

rock forms, and geologic features of unusual interest might in them find a proper setting. Here also might be found the subtle influence that nature has on our moral and physical well-being, the quality of wild places that appeals to many of us in such a strange, intimate way.

I should not like to convey the impression of believing all merely natural scenes and objects to be on that account necessarily beautiful, although nature contains so much beauty, not only in detail but even in combination. Neither does it seem to me that the operations of forestry generally result in producing æsthetic effects in the forest. Incidentally, although almost always unintentionally, certain new forms of beauty may be thus produced. On the whole the forests become stereotyped. Often it is the mere technical excellence of the artificial forest that makes it appear attractive in the eyes of the professional forester.

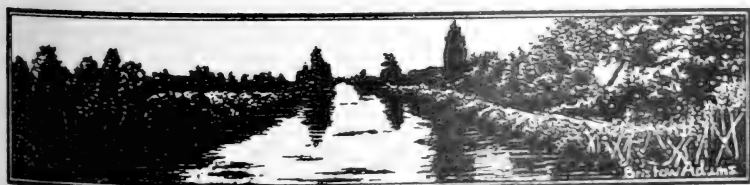
Our national forest reserves are still to a large extent in a wild, natural state, and it will be many years, in fact, before they shall have become impressed with the stamp of artificiality. Fire-scarred and over-grazed as many of them are, careful treatment can but improve the appearance which large areas in the reserves present to-day. And yet there are corners and ridges and valleys in these reserves that would retain a higher

scenic value by being left untouched, if such a sacrifice were possible. Would it not be possible to combine in each of the proposed special reservations the silicultural aims and the æsthetic ones?

Many people are deeply interested in the national forest reserves for other reasons than the material benefits which they will bring. There is, in fact, a very wide popular interest in nature for its own sake. This is shown not only by the decided increase of literature that deals with nature-study in its various forms, but by the tendency to live out of doors and to travel, by the increase of suburban and country homes, the formation of outdoor art associations and the rapid extension and development of public parks. Considering these things, and realizing also that by far the larger part of the forested areas of the United States are held by individuals and corporations, and that private owners cannot be expected to relinquish any part of their holdings for special purposes from which they can derive no tangible benefit, the question arises: cannot the government reserve certain selected areas, insignificant in their combined extent, for the purposes that have been indicated and as an uplifting influence for those that may come after us?

Very sincerely yours,

G. FREDERICK SCHWARZ.



WATER PROBLEMS OF SANTA BARBARA

A REPORT called "Water Problems of Santa Barbara, California," by Mr. J. B. Lippincott, which the United States Geological Survey has recently published, will be interesting to the many people who have found that the city and suburbs of Santa Barbara constitute one of the most attractive and most productive districts of that favored State. The locality is disappointing only in not possessing an adequate water supply.

In response to a request from the city and county of Santa Barbara, the United States Geological Survey has recently made topographic surveys that cover the entire district, and has investigated the water problems of the area. Maps of the Goleta, Santa Barbara, Santa Ynez, and Mount Pinos quadrangles have been published. The Santa Maria quadrangle has also been surveyed, and a map of it is now in the engravers' hands. In the hydrographic investigations the city of Santa Barbara has cooperated, paying one-half of the expense connected with the maintenance of gaging stations on Santa Ynez River and Mono Creek. On these streams daily observations have been made for silt, volume of flow, and mineral impurities of the water.

The district under investigation extends from Ventura River, in Ventura County, along the coast as far as Goleta, in Santa Barbara county, and more particularly into the high, mountainous districts of Ventura and Santa Barbara counties lying on the north side of the Santa Ynez Range and including the drainage basin of Santa Ynez River and its tributaries. The coastal plain fronting the ocean consists of a series of old marine beaches and undulating foothills facing Santa Barbara Channel. The Santa Ynez

Mountains run parallel to the coast, rising to elevations ranging from 3,000 to 4,000 feet and presenting a bold and attractive background to the foothill districts. A second range of mountains, consisting of the crest of the Coast Range and culminating in Mount Pinos, the elevation of which is 8,826 feet, lies farther north and trends parallel to the Santa Ynez Mountains, extending westward, parallel to the coast. It has a total length of about 70 miles, with flat grades, and offers frequent opportunities for impounding water in storage reservoirs.

Mr. Lippincott reviews the reports made by various distinguished engineers who have investigated the hydrography of the Santa Barbara and finds that all of them agree on the following vital points: (1) That the present supply of water for the city of Santa Barbara is inadequate and that unless it is increased the material development of the town will be seriously impeded; (2) That there is no adequate water supply within a reasonable limit of the city of Santa Barbara on the south side of the range, and even if the water of such small streams as are there could be obtained it would be at a sacrifice of existing development; (3) That it is feasible and desirable to obtain an adequate supply of water from the drainage basin of Santa Ynez River, and that this can be done at a profit.

Mr. Lippincott carries the investigation farther and concludes: (1) That the only extensive addition that can be made to the water supply of the Santa Barbara coastal plain is by the construction of a tunnel from Santa Ynez River to the coast side of the mountains and the erection of an impounding reservoir for holding the winter flood waters of Santa Ynez River; (2) That by far the most desir-

able point on Santa Ynez River for this construction is the Gibraltar reservoir site; (3) That the water can be delivered at a reasonable cost for both

irrigation and domestic use to Santa Barbara and vicinity from this site. Mr. Lippincott estimates in detail the cost of the work.

STREAM MEASUREMENTS IN THE UNITED STATES

THE sundry civil bill for 1906, passed by the last Congress contains an item of \$200,000 appropriated to the United States Geological Survey for the purpose of gaging streams and determining water supply. With this sum it is proposed to continue the work of measuring streams in all parts of the United States and of collecting data that will be helpful in promoting water powers and irrigation projects, and valuable in determining the quality of water best suited for domestic and municipal purposes and for manufacturing enterprises.

Estimates of the daily flow of important rivers are needed by engineers and investors, as is shown by the many requests for such information received from all parts of the country. It is believed that more than \$5,000,000 is annually expended in new projects that are stimulated largely by facts that have been ascertained officially during years of careful observation.

The water powers of New England have reached a high state of development, but many resources are not yet utilized—particularly those in Maine. There is constant demand for official data, and investigation will therefore be made of the character of certain New England waters with reference to their use for manufacturing purposes. Studies will also be made of the pollution of waters in this region from natural or artificial sources.

From New York southward in the Appalachian region a very extraordinary development of water powers is taking place, particularly in connection with cotton manufacture and electrical transmission. In some cases industrial investment is now awaiting the acquisition of definite information concerning the character of the waters.

From Ohio westward through the central Mississippi Valley, where the streams are relatively sluggish, water power is of less immediate importance than in the Eastern States, but here questions of adequate supplies of water suitable for manufacturing and industrial purposes are pressing. Plans are being made for the definite ascertainment of facts concerning the quantity and quality of supplies available from rivers and underground sources. When these facts are determined it will be possible to answer intelligently the numerous inquiries made as to the character of these supplies and their protection from manufacturing waste, sewage, and other destructive influences. Widespread information regarding the geology, topography, and water supply of the country should lead to great advances in manufacturing.

In the west the reclamation fund is available for the construction of irrigation works by the Government. At the same time the area available for agriculture will be largely increased by the construction of small irrigation systems. It is proposed to continue the measurement of streams in all the western states, in order to obtain data upon which to base investment of private or corporate capital, and to put on record information which can be obtained only by the Government, such as the measurements of interstate streams.

In short, it is proposed to continue, in nearly every state in the Union, the collection of facts concerning the surface and underground waters—their quantity, quality, and the influences which make them valuable or which destroy their usefulness for industrial purposes.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., April 29, 1905. Sealed proposals will be received at the office of the Engineer, U. S. Reclamation Service, Billings, Mont., until 2 o'clock p. m., June 28, 1905, and thereafter opened, for the construction of about 30 miles of canal, involving about 700,000 cubic yards of earthwork, some rock work and three tunnels, the same being a portion of a system for the diversion of about 400 cubic feet of water per second from the Yellowstone River at a point about ten miles east of Billings, and its conveyance to irrigable lands along the south side of said river. Specifications, forms of proposal, and plans may be obtained at the office of the Chief Engineer, U. S. Reclamation Service, Washington, D. C., or from R. S. Stockton, Engineer, Billings, Mont. Each bid must be accompanied by a certified check for \$1,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond as required. It must also be accompanied by the guaranty of responsible sureties to furnish bond as required, if the bid be accepted. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the service may require. Bidders are invited to be present. Proposals must be marked "Proposals for the construction of canal, Huntley project, Montana." E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., April 29, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Billings, Montana, until 2 o'clock p. m., June 28, 1905, and thereafter opened, for the construction of pumping station, concrete culverts, siphons, drops, etc., and furnishing two steel highway bridges, four steel sluice gates with stands, and 120,000 pounds steel bars for reinforcing concrete. Total amount of concrete about 1,600 cubic yards. Above work to be done along line of canal east from Huntley, Montana, in connection with the Huntley project. Specifications, form of proposal, and plans may be obtained at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., or from R. S. Stockton, Engineer, Billings, Montana. Each bid must be accompanied by a certified check for \$1,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of \$10,000 for the faithful performance of the work. It must also be accompanied by the guaranty of responsible sureties to furnish bond as required if the bid be accepted. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the service may require. Bidders are invited to be present. Proposals must be marked "Proposal for building structures and furnishing material, Huntley project, Montana." E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., June 9, 1905. Sealed proposals will be received at the office of the Supervising Engineer, United States Reclamation Service, 1108 Braly Building, Los Angeles, California, until 2 o'clock p. m., August 17, 1905, and thereafter opened, for the construction of about 12 miles of dike, involving excavation of about 445,000 cubic yards of earth, and clearing 125 acres, for the reclamation of Yuma Valley, Arizona. Specifications, forms of proposals and plans may be obtained from the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., from the Supervising Engineer, Los Angeles, California, and from the Engineer of the Reclamation Service, Yuma, Arizona. Each bid must be accompanied by a certified check for three (3) per cent. of the amount of the bid, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract, and furnish bond in the sum of 20 per cent. of the contract price for the faithful performance of the work. It must also be accompanied by the guaranty of responsible sureties to furnish bond as required, if the bid be accepted. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the Service may require. Bidders are invited to be present. Proposals must be marked; "Proposals for the construction of dikes, Yuma project." E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., May 23, 1905. Sealed proposals will be received at the office of the Engineer U. S. Reclamation Service, Belle Fourche, S. Dak., until 2 o'clock p. m., Monday, June 26, 1905, and thereafter opened, for the construction and completion of a telephone system, about 16 miles in length and having 4 telephone stations, in connection with the Belle Fourche project, near Belle Fourche, S. Dak. Specifications, forms of proposals, and particulars may be obtained from the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington D. C., or the Engineer in charge of the Belle Fourche project, Belle Fourche, S. Dak. Each bid must be accompanied by a certified check for 2 per cent. of the contract price, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 20 per cent. of the contract price for the faithful performance of the work. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects as the interests of the service may require. Proposals must be marked "Proposals for telephone system, Belle Fourche project, S. Dak." E. A. HITCHCOCK, Secretary.

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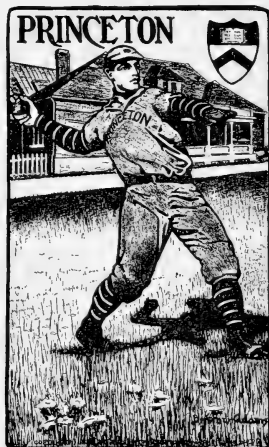
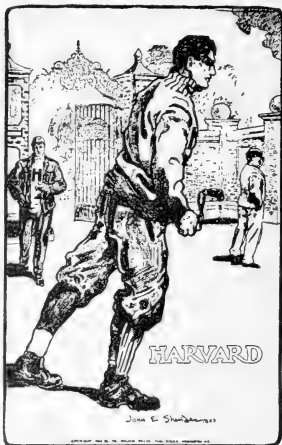
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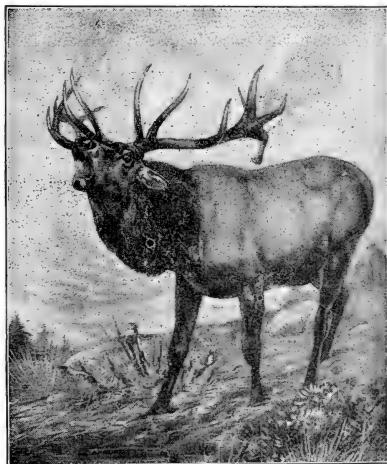
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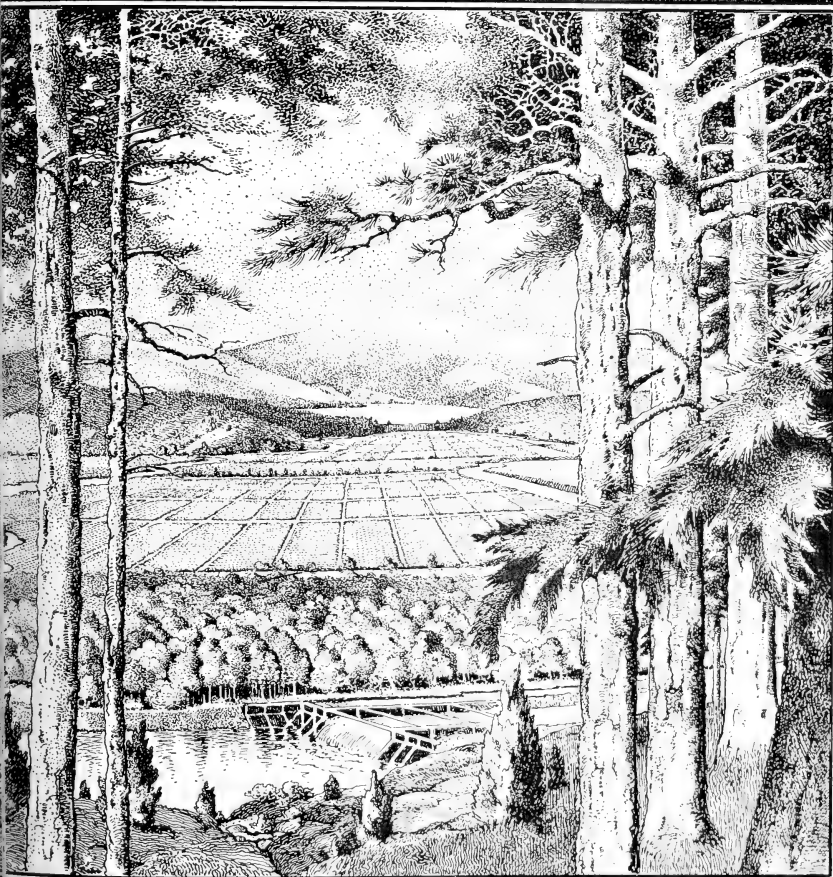
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- GENERAL OUTLOOK FOR RECLAMATION WORK IN CALIFORNIA. By J. F. Lippincott, Supervising Engineer, U. S. Reclamation Service.
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President—HON. JAMES WILSON,

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The American Forestry Association was organized in 1882, and incorporated in January, 1897. It now has nearly three thousand members, residents of every State in the Union, Canada, and foreign countries. It has at all times been active in promoting measures tending toward the proper utilization of the forests and their protection from destruction by fires and wasteful use.

The objects of this Association are to promote :

1. A business-like and conservative use and treatment of the forest resources of this country ;
2. The advancement of legislation tending to this end, both in the States and the Congress of the United States, the inauguration of forest administration by the Federal Government and by the States ; and the extension of sound forestry by all proper methods ;
3. The diffusion of knowledge regarding the conservation, management, and renewal of forests, the proper utilization of their products, methods of reforestation of waste lands, and the planting of trees.

The Association desires and needs as members all who are interested in promoting the objects for which it is organized—all who realize the importance of using the natural resources of the country in such a manner as not to exhaust them, or to work ruin to other interests. In particular it appeals to owners of wood-lands, to lumbermen and foresters, as well as to engineers, professional, and business men who have to do with wood and its manifold uses, and to persons concerned in the conservation of water supplies for irrigation or other purposes.

The American Forestry Association holds annual and special meetings at different places in the country for the discussion and exchange of ideas, and to stimulate interest in its objects. *Forestry and Irrigation*, the magazine of authority in its special field, is the official organ of the Association, and is sent free to every member monthly. Its list of contributors includes practically all persons prominent in forest work in the United States, making it alone worth the cost of annual membership in the Association.

The annual dues are, for regular members, \$2.00, for sustaining members, \$25.00 ; life membership is \$100, with no further dues. Any person contributing \$1,000 to the funds of the Association shall be a Patron.

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INCORPORATED JANUARY, 1897

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The Proceedings

OF THE

American Forest Congress

recently held at Washington, D. C.,
have been published in book form

This volume contains the full list of notable addresses and papers delivered at the several sessions of the Congress, a list of the delegates who were present, and the text of the resolutions adopted.

Altogether it forms the most comprehensive and authoritative publication on the subject of forestry that has yet been issued in the United States.

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Forestry and Irrigation

H. M. SUTER, Editor

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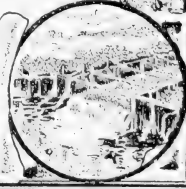
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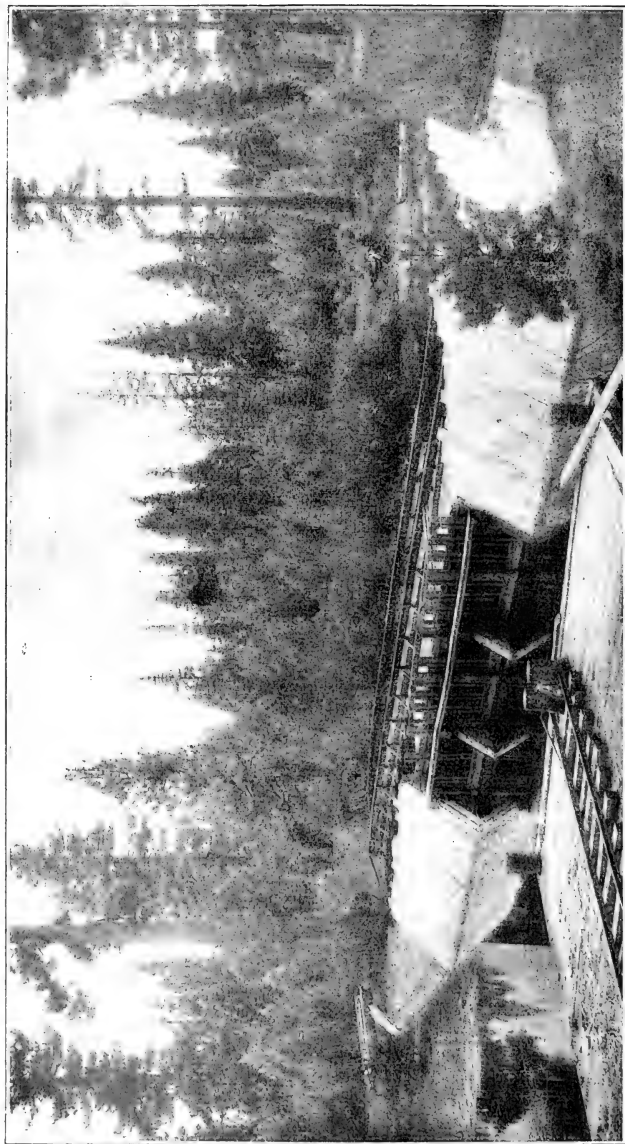
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JOHN E. SHERIDAN



OUTLET OF LAKE TAHOE, NEVADA

Forestry and Irrigation.

VOL. XI.

JULY, 1905.

No. 7

NEWS AND NOTES

Forestry in Connecticut

This number of FORESTRY AND IRRIGATION devotes considerable space to the forest work now going on in the State of Connecticut. Mr. Austin F. Hawes, State Forester, describes the prevailing forest conditions and suggests methods for their

law passed by the Connecticut legislature on July 5.

From the information given by Mr. Hawes and others it would seem that the forest resources of this state could be greatly increased by judicious management of the present stands, supplemented by planting. Individuals as



MR. AUSTIN F. HAWES

Formerly a member of the Bureau of Forestry; at present he is State Forester of Connecticut in charge of all forest work

improvement. Miss Winslow contributes a short history of the Connecticut Forestry Association, an organization which is almost ten years old, and which is growing in influence. There is also given the full text of the forest

well as the state have alike a good opportunity. It seems that the main thing needed is to spread the knowledge of what to do, and excellent results are likely to follow. For this reason the publisher of FORESTRY AND

IRRIGATION is glad to give space to this project, with a hope of assisting the laudable work undertaken by the Connecticut Forestry Association. The forests of Connecticut can be made a substantial and enduring resource of the state, and it is the duty of its press and the people to back up this idea.

Reclamation Service Personals Edward C. Cordell has been appointed bookkeeper in the Reclamation Service and directed to report for duty to L. C. Hill, Roosevelt, Arizona.

Geo. E. H. Goodner has received an appointment as clerk and assigned to duty in the Washington office.

Miss Rosa M. Layton, of Denver, has been appointed stenographer and typewriter and assigned to duty in the Denver office.

Richard G. Manifold, who has been temporarily employed in drafting in the Denver office, has received an appointment under classified service and will continue work under H. A. Storrs, Denver.

F. W. Brose, clerk in Washington office, designated special disbursing agent, and detailed for duty on Hondo project, New Mexico.

Frank C. Dillard has received an appointment as engineering aid and directed to report for duty to J. T. Whistler, Pendleton, Oregon. He is a graduate of the University of Oregon, and has been engaged in Coast and Geodetic surveys in California and Oregon.

Sherman C. Fiske, draftsman in the U. S. Treasury Department, has been transferred to the Reclamation Service and assigned to duty in the Washington office.

Howard S. Reed, of Utah, assistant engineer, has been transferred from Uintah Indian Reservation, Utah, to hydrographic work under L. C. Hill at Phoenix, Arizona. Mr. Reed has had experience in surveying with Moore & Co., on Boston water works, with the Nicaragua and Isthmian Canal Commission, on the Salt River project, Arizona, and assisted in preparing U. S. Geological Survey annual

report. Since June, 1902, he has been engaged as hydrographer and assistant engineer on the Uintah Indian Reservation.

Aldus H. Shellenberger, clerk in office of Secretary of the Interior, has been transferred to the Reclamation Service and assigned to duty in Accounts Division, Washington office.

John W. Swift, bookkeeper in Washington office, has been designated special disbursing agent at Billings, Montana.

Forest Service Personals

E. T. Allen, of the Forest Service, has been appointed by the governor State Forester of California. For the past six years Mr. Allen has been connected with the Bureau of Forestry, although one year of that time was spent as forest reserve inspector for the Land Office. In his new position Mr. Allen will continue as inspector of the forest reserves in California for the Forest Service. He is a thoroughly competent forester, is very familiar with forest conditions in the West, especially in California, and the governor of that state could not have made a better appointment.

G. B. Iull, of the Forest Service, is at Portland, Oregon, acting as the representative of the Service in charge of the government forest exhibit at the Lewis and Clark Centennial Exposition. He will see to it that visitors are furnished all desired information concerning the exhibit and the work the Service is doing, and he will have charge of the courses of popular illustrated lectures on forestry which will be given.

Mr. John H. Hatton has been assigned to duty as Forest Inspector on national forest reserves. His district will include Utah and possibly South Dakota. During July he has been assisting the U. S. Civil Service Commission in the examinations for forest rangers at several places in Colorado.

Mr. Smith Riley has been assigned to duty at Forest Inspector on the national forest reserves. His district will comprise all the forest reserves

in the State of Colorado and the Big Horn and Medicine Bow reserves in Wyoming. He will also assist the U. S. Civil Service Commission in the conduct of examinations for positions of forest ranger at certain places in Colorado.

A. E. Cohoon has been assigned as technical assistant to S. C. Bartrum, Forest Supervisor for the southern division of the Cascade Range Forest Reserve, Oregon.

Ranger Lewis Newcomb, of the San Bernardino Forest Reserve, California, has resigned from the Service.

Suit Against Cornell

Another chapter in the movement that brought about the establishment and later the discontinuance of the New York State College of Forestry has been opened.

Attorney General Mayer, of New York, has decided to bring an action to deprive Cornell University of 30,000 acres of timber land between Tupper and Upper Saranac Lakes, in the Adirondacks. Mr. Mayer will endeavor also to break a contract whereby Cornell has permitted the Brooklyn Coopercage Company to cut timber on the tract.

This tract was purchased by Cornell with \$165,000 out of an appropriation of \$500,000 made by the legislature of 1898 for a forestry experiment, to last thirty years. The Brooklyn company began cutting timber on the tract in 1900, and as a result people who lived in the vicinity protested vigorously. Inquiries were made into the forestry experiment, which was being carried on under the direction of Dr. B. E. Fernow, head of the New York State College of Forestry.

Governor Odell in 1903 declined to permit any more money to go out for the experiment, and that came to an end. The Brooklyn company, however, still continued to cut timber, and the Association of Residents of Upper Saranac Lake, who had fought the Cornell idea from the first, asked Mr. Mayer to bring an action that would terminate the contract. They

declared that the purpose of the statute was being defeated, as the enterprise was not a forestry experiment.

In his opinion handed down to-day Mr. Mayer says:

"There is no suggestion that the authorities of Cornell University entered into this contract through other than good motives. It seems that they had been advised by the forestry expert in their employ that the best method of experiment was to denude the tract, in order that the result of reforestation could be ascertained within the life of men then living.

"So far as the testimony and arguments before me disclosed, no official of the State of New York was consulted, directly or indirectly, in regard to the agreement above referred to. It cannot be said, therefore, that the state was in any way responsible for this contract, or that it acquiesced in the terms thereof.

"In my opinion, it was never contemplated that under any circumstances Cornell was to be permitted to make a contract for the stripping of the forest within a possible fifteen years on a tract of land which was dedicated to an educational experiment of thirty years."

Bridge Contract

The Secretary of the Interior has awarded the contract for the construction of a pile bridge across North Platte River, about 25 miles southwest of Casper, Wyoming, to James F. Stanley, of Casper.

This bridge is to be used in connection with the North Platte project. Three bids were received, of which Mr. Stanley's—\$3,384.70—was the lowest.

Bids for Tunnel

The Secretary of the Interior is advertising for bids for the construction of the Corbett diversion tunnel, Shoshone project, Wyoming. This tunnel is to be approximately 17,000 feet long. The auxiliary works will include the excavation of about 28,000 cubic yards of material in open cut. These works are located about 10 miles east of

Cody. The proposals will be received at Billings, Montana, and will be opened on September 6, 1905. Particulars may be obtained by addressing the Chief Engineer, Washington, D. C., or the engineer in charge, Mr. J. Ahern, Cody, Wyoming.

**More About
Silviculture**

The following letter, commenting on the suggestions contained in Mr. Schwarz's letter to the editor and published in the June number of *FOR-*

Editor FORESTRY AND IRRIGATION:

Dear Sir:—The proposal by Mr. Frederick Schwartz, in *FORESTRY AND IRRIGATION* for June, that portions of the forest reserves be utilized as silvicultural sample plots on a large scale, deserves thorough consideration. Probably every forester will admit that our knowledge of silviculture at the present time is almost purely empirical. The notes found in the books regarding the "silvicultural charac-



MR. WALTER MULFORD

First State Forester of Connecticut who did much to interest the people of that state in forestry. He is now with the U. S. Forest Service, but later will become a member of the Faculty of the Forest Department at the University of Michigan.

ESTRY AND IRRIGATION, from Mr. Ernest Bruncken, author of "American Forests and Forestry," is given in full, as an indication that the study of silviculture in America is a subject of deep interest to our foresters:

ters" of forest species are hardly more valuable than the directions printed on the five-cent packages of garden seeds one buys at the corner groceries. The time for a scientific silviculture, however, has hardly yet arrived. It pre-

supposes a far more thorough knowledge of ecology than has been attained so far. For investigations of this kind the reserve sample plots suggested by Mr. Schwartz would serve excellently. The field study of ecology is at the present time handicapped by the fact that there are no accurate records of observations regarding changes in the flora of definite areas, extended over considerable periods of time. Such records cannot be obtained under ordinary conditions, because the factor of human interference cannot be sufficiently eliminated. If every forest reserve had one or more districts of reasonable size set apart and protected against all human disturbance, these would go far in helping to discover the laws by which natural conditions affect tree growth.

Perhaps it would be feasible for the Forest Service to enlist the coöperation of the botanical departments of the various universities in this work. A great deal of geological field work is now being done by botanists. There is reason to believe that they would welcome such a policy, especially if in the neighborhood of each protected tract a simple laboratory containing facilities for the most indispensable physiological and morphological work could be erected.

ERNEST BRUNCKEN.

Sacramento, Cal.

Forests and Water An apt illustration of the relation between forests and the conservation of water is shown in a recent letter by Clinton Harris, of Nashville, Tenn., printed in *Recreation*. The letter is as follows:

"To illustrate the relationship between forests and water, make a couple of troughs, line one with clay to represent the country denuded of trees, the opposite trough line with sods of grass or moss to represent the forest-clad mountain side, set them on an incline and connect their upper ends with a rough reservoir. Pour a pail of water into this reservoir and there will be a wild rush of water down the

clay-lined trough, while the moss and grass-lined one will drip for hours.

"It only needs a little imagination to convert this machine into a forest-clad mountain and one denuded of timber.

"The cloudburst represented by the contents of the bucket of water suddenly poured into the top reservoir is only a dangerous cloudburst on the barren slope. By the use of this simple device you can explain to a child the absolute necessity of preserving the forests upon the watersheds, if we would have continuous running water and not the certainty of flood and drought which are caused by the watersheds being recklessly denuded of timber."

Work of Forest Service

The Forest Service during the summer field season issues monthly a schedule of field work and assignments. The programme for July indicates work in 21 states and territories and in Hawaii. It includes the making of working plans and planting plans, fire protection studies, the care of forest nurseries, inspection of forest reserves, special studies of trees and their products, timber seasoning and testing, and many other practical lines of work in which the Forest Service is engaged. The names, addresses, and character of study of all Forest Service officials engaged in this work and also of those having direct charge of the different forest reserves will be published monthly in the field programme. In another part of this number of *FORESTRY AND IRRIGATION* the work of the Forest Service is treated somewhat in detail.

Studying Lumber Trade

A new section called "lumber trade" was created by the Forest Service July 1, in the office of Forest Products. Its purpose is to study the supply, transportation, markets, and use of lumber and other forest products. The various grading specifications will be brought together for comparison by both buyers and sellers of lumber, as has been done in the case of log rules. Hitherto there has

been a decennial census of the lumber industry, but the intention now is to publish, in coöperation with the National Lumber Manufacturers' Association, an annual statement of the amount of lumber cut and marketed. The movement of lumber will be followed from the forests through the great commercial centers until it reaches the consumers.

Special uses of wood as for coöperation and boxes, vehicles and implements, and for paving blocks will be carefully considered. The study will include an investigation of the qualities of the woods at present used; an estimate of the supply of timber of these kinds available; an investigation of the properties of other and more abundant woods which may be substituted for the species now employed; and a study of methods of manufacture with a view to recommending improvements which will increase the output and lessen the waste from the raw material.

Vermont Forest Experiment

The Reading Pond Trout Club, which was organized in March, will do business on a large scale. The capital stock of the corporation, originally \$3,000, has been increased to \$50,000, which is held by men deeply interested in the development of Vermont. The club has acquired 5,500 acres of woodland, meadow, pasture, and tillage land in the vicinity of Reading Pond, near Woodstock. In pursuit of the propagation of game fish, 30,000 brook trout have already been deposited in the brooks and pond; but the larger plans of the club, and those in which the public is directly interested are, however, along the lines of scientific forestry and farming.

It is not designed that these lands, which include some of the best and some of the worst in Vermont, shall lie idle. On the contrary, the forests, in the first place, are to be managed on the most economic principles. Instead of stripping the woodlands and reducing them to a nominal value in

a season or two, it is expected that they will be lumbered so that they will increase in value from year to year. Only such timber will be cut as is mature, and there will be planting to replace those trees that are felled. Wastes, slopes, elevations, and localities will be carefully studied; large areas will be planted with German and Colorado spruce, white and black ash, cherry and various other hard and soft woods, and results watched with a view to determining what timber trees are most profitable in the different locations.

Competent men will be in charge of the lands and the working out of the forest problem will be watched with considerable interest.

Timber Sta- tistics

Steps have just been taken to determine the total annual cut and consumption of lumber in the United States. The National Lumber Manufacturers' Association, at its last meeting in Chicago, favored the getting of such statistics, and the Bureau of Forestry for some time has been considering similar work; the two have now combined forces to this end. Mr. George K. Smith, the secretary of the association, recently visited Washington to confer with the Bureau, and a definite plan has been decided upon. Near the close of each calendar year blanks will be sent the secretaries of all lumber associations, who will forward them to all saw-mills in their jurisdiction. When filled in these cards will show the total cut of each mill, the total shipments, and the stock left on hand; they will then be mailed direct to Washington. The Department of Commerce and Labor will assist in the work in the way of furnishing names of lumbermen, and in computing the results. The plan will be put into effect at the close of this year, and as early as possible after January 1 a statement of results will be published. The proposed work will be of great practical value in determining the rate at which the forest resources of the country are actually being used up.

WILLIAM FAIRCHILD HUBBARD

BY

GEORGE B. SUDWORTH

THE premature death of William Fairchild Hubbard deprives the forest profession of one of its brightest members. He lost his life on July 17, 1905, while canoeing near the

panion was carried swiftly downstream, barely escaping death.

Mr. Hubbard was a professional forester by training, and at the time of his death held the position of For-



WILLIAM FAIRCHILD HUBBARD

Great Falls of the Potomac River, in company with Mr. Robert W. Ayres. The canoe was capsized in a powerful back-current, throwing both men into the water. Although an exceptionally strong swimmer, Mr. Hubbard was unable to save himself, while his com-

est Assistant in the Forest Service of the United States Department of Agriculture, having entered the department in February, 1901. He was born in North Carolina in 1876. His early education was received in the public schools of Washington, D. C., and in

Trinity University, Toronto, Ontario. Subsequently he studied forestry at the universities of Munich and Tübingen, receiving from the latter institution the degree of Doctor of Political Sciences. During his course of forest study he served as voluntary assistant in one of the government forests of Thuringia. He qualified for the United States Forest Service by passing the Civil Service examination for trained foresters, and similarly also for the Philippine forest service, which at one time he anticipated entering.

Through his special academic training in political sciences, Mr. Hubbard brought to his professional work in forestry a rare but most valuable attainment—a knowledge of the important part which forests and their proper use play in the economic life of the nation.

For one so young, Mr. Hubbard had achieved much in practical forest work that does lasting honor to his name. Among his important contributions published and being published by the Forest Service, is a bulletin on the basket willow, a study which makes available new facts of great value to an important American industry. He has also prepared in collaboration with Colonel William F. Fox a bulletin on the maple sugar industry. Mr. Hubbard's contribution to this publication—just now going through press—is a discussion of the silvical requirements of sugar maples in their relation to sugar production, as well as a large part of the discussion relative to the commercial status of maple sugar.

But a few days before his death Mr. Hubbard practically finished a most valuable paper for publication, entitled "Forests and Forestry in the United States." In this he has traced the bearing which our wealth of tim-

ber has had upon the development of the country, and the relationship which the forested regions bore to the commercial and economic standing of various communities. Fortunately, on account of its great value, he had also outlined and practically completed a plan for the protection from fire of a large timber tract in northern California. This plan was based upon field studies conducted last summer, and had already been accepted and put into effect.

Besides these larger accomplishments, Mr. Hubbard has conducted a number of minor but important forest studies. To all was given the stamp of his peculiarly original thought. In no manner did he display the perhaps too common school-bred narrowness of university men. His mind was quick to grasp the practical bearings of a problem and to solve it in the most direct way. The government forest work to which he was assigned interested him deeply beyond the matter of official duty. He often found time to contribute valuable discussions in connection with them for publication in the forest journals of the country.

His devotion to forestry and his achievement in that field led to his election, in 1902, as an active member of the Society of American Foresters, in the proceedings of which he took the greatest interest.

Mr. Hubbard possessed a most attractive personality, and was very highly esteemed by all who knew him well for the gentleness of his nature and for his manly character. He was recognized at once as a leading spirit among his friends and in almost every movement with which he was connected. His untimely death is to be regretted the more, since he gave promise of more than ordinary achievement in his profession.



FORESTS AND FORESTRY IN CONNECTICUT

BY

AUSTIN F. HAWES

State Forester of Connecticut

LIKE the rest of southern New England, the forest area of Connecticut is steadily increasing, and this misleads many to think that the forest question will care for itself. The great trouble is, of course, in the poor character of much of this woody growth, and the scant chance which it has in the natural course of events to become of any value for at least a generation. On the other hand there is a great deal of valuable woodland in all parts of the state which serves as a good example of what is possible.

Chestnut is the most important tree of the state and in many forests forms the largest portion of the mixture. Next in importance is the white pine which forms pure stands in the northeast part of the state and is mixed with chestnut and oaks and other hardwoods throughout the northern section. There is probably no virgin timber in the state, the white pine stands being largely the growth which has encroached on abandoned fields and the sprout woods bear evidence of two or often three generations.

Probably nearly one quarter of the total area of the state is nearly worthless land, which is gradually coming up to gray birch, pitch pine, and juniper. This land has an average value of perhaps \$3 an acre, the price varying with the locality. Some of the most barren wastes which lie near railroads are held as possible factory sites at \$5 to \$10 an acre. While some of this land is now yielding a scanty supply of cord wood, the prices from such material, except near the cities, are so low that the owners place practically no value upon their land and allow it to remain totally neglected and to be

frequently burned over. One of the first things for forestry to demonstrate is that it is entirely feasible in most cases to plant up such land as this.

The thrifty growing young forests offer every inducement for thinning, especially is this the case in the sprout growth of chestnut and oaks. The highest values from such forests are derived where there is a good crop of poles and railroad ties. Poles delivered bring as high as \$13 apiece, the average thirty foot pole selling from \$2.50 to \$3. The first grade of railroad ties are now sold for 42 cents, and the seconds for 30 cents. There is always a large proportion of inferior trees in these natural stands which not only will never give these valuable products, but also interfere with the best development of the good trees. In remote situations where the cost of removal might eat up the small profit in cordwood thinnings can often be made remunerative by converting the wood into charcoal. The customary reckoning is that 30 cords of wood will produce 1,000 bushels of coal. The value of the "coal" is seven to eight cents a bushel. The cost of burning sixty cords amounts to about \$45, leaving \$1.58 as the average return for stumpage, cost of cutting the wood and hauling the charcoal. As the cost of cutting amounts to 90 cents to \$1, the result gives a low stumpage value. In fact in some localities where the coal burners buy stumpage they pay 33 cents a cord. These figures show, however, that in most remote sections such thinnings can pay for themselves. One of the advantages in burning into coal results from the fact that round wood can be used, while there is



Part of Connecticut State Forest after thinning. The cost of this land to the State was two dollars an acre.

scarcely any market for this young material as wood. In good sprout stands, 30 years old, eight or ten cords of this inferior material can usually be removed from an acre, thus giving the remaining trees plenty of room for development. The high values which have resulted from untreated sprout stands encourages one to expect even greater returns from systematic treatment of this sort. I have a record of a lot of about three acres from which were cut 67,000 feet B. M. of chestnut

ferent. The lack of knowledge on the part of the farmer as to the value of his pine timber results in lumbermen being able to buy it for very low figures. This is not so much the case now as it was a few years ago, for with the growing scarcity of stumpage there is naturally some appreciation in prices. There are no large lumbermen in the state, but there are in every locality men controlling portable saw mills who cut from one-half million to four or five million feet a year, including



Planting forest trees on sand plain in Connecticut. This land is assessed at six dollars an acre though worthless for agriculture.

and oak lumber and poles enough for 10,000 feet more, besides 118 cords of wood. Another ten acre lot of sprouts about forty years old sold recently for \$1,000, though the land itself was probably not valued at over \$5 an acre.

Many of the owners of such hardwood land appreciate the value of thinnings since they are holding their lands for a definite purpose, that of producing poles and ties which require a growth of about 40 years.

The white pine problem is quite dif-

ficulties and poles. While the competition among these men is now so keen that they are obliged to bid up to prices somewhat approaching the actual value of the woodlots, they sometimes overcome this difficulty by agreeing among themselves on a satisfactory distribution of the lots for sale. These lumbermen are usually men who started in with very little capital, but have gradually increased their business. They aim to turn over their money as soon as possible, and for this reason

these pine stands are cut off when they are far from mature. On white pine between thirty and forty years old lumbermen frequently make over 30 per cent. on the money invested within a year or so after purchase. While this young pine may be growing at a most excellent rate, possibly as high as 8 per cent., there is little inducement for holding if these much higher immediate returns can be realized and the operation repeated indefinitely.

A few figures illustrating the character of these forests may be of interest. One lot of four and one-half acres gave a yield of nearly 100,000 feet B. M.. Boxboards are now worth about \$12 a thousand delivered at the railroad, while some of the square edge pine runs as high as \$16. From 25 to 50 per cent. of the cut is usually of the latter character. In Union, the principal pine town of the state, an 80 acre lot sold this winter at \$100 an acre. The general character of the pine stand in this region is illustrated by a lot of fifteen and one-half acres which produced 459,000 feet B. M., or an average of nearly 30,000 feet. The net profit on this lot to the lumberman amounted to \$2,000. Some of the original virgin pine timber, the last of which was cut about fifteen years ago, is reported to have run 100,000 feet to the acre.

If this state of things could last indefinitely there could be no particular objection to the present methods, but since the supply of pine is rapidly approaching exhaustion the cutting of this immature, rapid growing pine is naturally a source of regret. The only remedy seems to be the education of the land owners to an appreciation of the real value of their timber and the rate of interest at which it is growing. If they understood that their timber is growing at a rapid rate of interest and that prices are also increasing they would hold this timber and could be induced to practice forestry. The lumbermen would also benefit in the end for the stability of their business would be maintained.

If these forests were kept to an age of sixty to seventy-five years instead of being cut at about forty there would be opportunity for good forestry work. There is little doubt that careful thinning would result in very much better lumber and greater yields. Thinnings are in most cases perfectly feasible. I have the opinion of a lumberman for authority that when lumbering is going on in a region neighboring stands could be thinned out without financial loss. Where the trees to be removed are six inches in diameter or over they can be sawed into boxboards, and in some sections there is a market for pine fuel.

The question of production is, perhaps, the most important. White pine is naturally such a fine reproducer that it seems there should be no difficulty in securing a new stand. Methods of lumbering in common use remove everything on the land so that not only no seed trees are left, but patches of reproduction which are often very thick and sometimes ten feet high are totally destroyed. Where lumbermen have purchased the land as well as the timber they should be far-sighted enough to leave seed trees, and there are always plenty of worthless trees on a lot which could serve for such purposes. Strange to say there seems to be more interest among lumbermen in planting this land after lumbering than in making any attempt at natural reproduction. Owners who sell to lumbermen simply the timber, retaining the land, could easily make some contract whereby seed trees would be left.

Undoubtedly the clear cutting method yields the highest present financial results, but these forests are admirably suited to either the strip or group system of regeneration and one of these would probably prove most remunerative in the long run.

One of the chief objections to holding pine until maturity is, of course, the danger from fire. This, as everywhere, is the chief impediment to for-

estry. There are at present* no adequate laws against fire, but there is now a bill before the General Assembly for the purpose of creating a fire service similar to that of New York, but combining some of the good points of other state laws and a few original measures.

The forestry movement in the state was inaugurated some three years ago under the direction of the Agricultural Experiment Station. The station appointed a forester with the hope of interesting the land owners of the state in forestry work. As one of the first steps toward this an experimental plantation was started a few miles north of Hartford on a sand plain. About sixty acres of land valued at \$6 an acre have been planted to different species, as shown by the accompanying diagram. These plantations have been as experiments in methods of planting, distance of spacing, and value of different mixtures. A new series of experiments is now being undertaken on adjoining land of similar character to ascertain how cheaply planting can be done.

The station has recently published a circular advertising its scheme of cooperation with private owners which is similar to that of the national Forest Service, and of the State Forester of Massachusetts.

By act of legislature the Station Forester was made State Forester; the principal duties connected with this office being the creation and care of a state forest. This law, which has thus far carried an annual appropriation of \$1,000, provides that the forester may buy land at a price not exceeding \$4 an acre. He may plant this land, or make thinnings or take such other measures as he may deem necessary to bring about a profitable growth of the timber thereon. Up to the present time about one thousand acres of sprout land have been purchased in the towns of Portland and Chatham at an average cost of \$1.63 an acre. As an appreciation of forestry gradually grows in the state it is hoped that a more generous appropriation may be devoted to the work and greater progress made.

*NOTE.—Since foregoing article was written a fire law has been passed and text given in this number.

THE CONNECTICUT FORESTRY ASSOCIATION

Short History of the Organization that is Promoting the Cause of Forestry in Connecticut

BY

MARY WINSLOW

THE Connecticut Forestry Association was founded in December, 1895, by the late Rev. Horace Winslow, and a few others, at the house of the former in Weatogue, in the old town of Simsbury. Mr. Winslow was the first president and continued in office until May, 1898, when on account of failing health, he declined a re-election.

Mr. Winslow was succeeded by Major Edward V. Preston, of Hartford. When Major Preston was compelled by the pressure of important business to lay aside the office, he was followed by Mr. Walter Mulford, then State Forester for Connecticut, but now of the Forest Service of the U. S. Department of Agriculture, who was in turn succeeded by Dr. E. H. Jenkins

director of the Connecticut Agricultural Experiment Station at New Haven.

The chief objects of the Association are: To develop public appreciation of the value of forests and woodlands and of the need for preserving and using them rationally; to forward the establishment of forests, parks, and reservations; to disseminate information regarding forestry and kindred topics.

In the State of Connecticut, land from which the timber has been removed is so naturally and quickly recovered with tree growth that at one time it was a difficult matter to convince some persons that an organization of this character was needed at all. Other people thought we had trees enough. Still others seemed to care little whether or not any trees were left on the highways for shade or ornament. So the Association has had some discouragements to meet and indifference to overcome, but in spite of all, now is apparently on a firm basis, and likely to live, prosper, and to accomplish much for the cause of forestry.

As the subject is brought more and more before the minds of the people, they are beginning to realize that all of forestry is not expressed by the act of *planting trees*, nor by that of *cutting them down*. But they do see that to manage a farm, or even a woodlot, in a practical manner requires the exer-

cise of as much thought and common sense as to raise an agricultural crop.

The Connecticut Forestry Association has held some public meetings, with speakers of eminent rank, and it is planned to have more such meetings in different cities of the state, at frequent intervals. It has also printed and distributed widely through the state, a number of leaflets, and these are only the beginnings of a series of such.

The publication committee is to commence very soon, a sort of propaganda by means of the press of Connecticut, and excellent results are anticipated from this work.

The officers of the Association, elected in May, 1905, are as follows: President, Dr. E. H. Jenkins, New Haven, Conn.; vice-presidents, Prof. Henry Ferguson, Hartford; Hon. T. S. Gold, West Cornwall, and Mr. Willis I. Twitchell, Hartford; recording secretary, Mr. Everett S. Geer, Hartford; corresponding secretary, Miss Mary Winslow, Weatogue; treasurer, Mr. Alfred Spencer, Jr., Hartford; auditor, Mr. Appleton R. Hillyer, Hartford; advisory board, the above-named and Major Edward V. Preston, Hartford; Mr. Edward A. Bowers, New Haven, and Mrs. Bessie G. Gerard, South Norwalk.

Publication Committee—Dr. E. H. Jenkins, New Haven; Mr. Austin F. Hawes, State Forester, and Miss Mary Winslow.

CONNECTICUT'S NEW FOREST LAW

Passed by Legislature on July 5th, and deals with Forest
Fire Wardens and the Protection of Forests from Fire

Section 1. The state forester shall be, *ex officio*, state forest fire warden, and shall receive no additional compensation therefor, but shall receive his necessary traveling and other expenses, to be paid in the manner pro-

vided for in section 4450 of the general statutes.

Sec. 2. Said forest fire warden shall have supervision of town fire wardens, shall instruct them in their duties, enforce the law as to fire districts in

towns, issue such regulations and instructions to the town and district fire wardens as he may deem necessary for the purposes of this act, and cause violations of the laws regarding forest fires to be prosecuted.

Sec. 3. The selectment of any town shall, upon the request of the state forest fire warden and with his concurrence, appoint a town fire warden who shall act for the term of one year under the instructions of said state warden. When required by the state warden, such town fire warden shall, and any such town fire warden may establish two or more fire districts in the town for which he is appointed, and appoint a resident of such district as district fire warden; in the absence of town and district fire wardens, the first selectman may act as fire warden.

Sec. 4. Town and district fire wardens shall prevent and extinguish forest fires in their respective towns, and enforce all statutes of this state now in force or that may hereafter be enacted for the protection of forest and timber land from fire, and they shall have control and direction of all persons and apparatus while engaged in extinguishing forest fires, outside the limits of cities or boroughs. Any fire warden may arrest, without a warrant, any person or persons taken by him in the act of violating any of the said laws for the protection of forest and timber lands, and bring such person or persons forthwith before a justice of the peace or other magistrate having jurisdiction, who shall proceed without delay to hear, try, and determine the matter. During a season of drouth the town fire warden may establish a fire patrol in the town, and in case of fire in or threatening any forest or woodland the town and district fire wardens shall attend forthwith, and use all necessary means to confine and extinguish such fire. The said fire wardens may destroy fences, plow land, or, in an emergency, set backfires to check any fire. They may summon any male resident of the town

between the ages of eighteen and fifty years to assist in extinguishing fires, and may also require the use of horses and other property needed for such purpose; any person so summoned and who is physically able who refuses or neglects to assist or to allow the use of horses, wagons, or other material required, shall be liable to a penalty of not less than five dollars nor more than one hundred dollars. No action for trespass shall lie against any person crossing or working upon lands of another to extinguish fire.

Sec. 5. The town and district fire wardens shall receive two dollars and fifty cents per day for time actually employed at forest fires or in the prevention thereof. The selectmen shall fix the price per hour to be paid to laborers at forest fires, employed by the fire wardens or their deputies, not exceeding twenty cents per hour, and shall give notice thereof to the town fire warden and the state forest fire warden; but if the selectmen neglect to fix said price the town fire warden may pay at the rate of twenty cents per hour for such services. The said wardens shall render to the selectmen a statement of the services rendered by them and by the men, teams, and the other apparatus employed by them as provided by this act, within one month of the date of such services, which said bill shall show on detail the amount and character of the services performed, the exact duration thereof, and all disbursements made by said wardens; said bill shall be audited, and if approved by the selectmen of the town wherein such services were rendered and expenses incurred, shall be paid on the order of said selectmen by the town treasurer. A duplicate bill, showing that the same has been audited and paid by the town, shall be filed by the town treasurer with the state forest fire warden; a copy thereof shall also be sent by said treasurer to the county commissioners of the county in which said town is situated, and the commissioners shall thereupon draw their order on the

county treasurer in favor of said town for one-fourth of the amount of said bill, and another copy shall be sent to the state comptroller, who shall draw his order on the state treasurer in favor of said town for one-fourth of the amount of said bill.

Sec. 6. All moneys received from fines imposed under and by virtue of the provisions of sections 1218, 1222, and 1237 of the general statutes shall be paid to the state treasurer and kept by him as a separate fund, to be paid out by him upon the requisition of the state forest fire warden, for use in connection with the prevention and suppression of forest fires, and such disbursements shall be audited by the state board of control as provided in section 4450; *provided*, that the state forest fire warden shall pay one-half of the amount collected as a fine to the fire warden or other person upon whose information the proceedings in which such fine was imposed were instituted, but not exceeding fifty dollars in any one case.

Sec. 7. Section 1218 of the general statutes is hereby amended to read as follows: Every person who shall set on fire any woods, or stack of hay or grain, so as thereby to occasion injury to another; or shall injure or destroy any public bridge, or any fire engine or hose, or any mill-dam, or hydraulic works, or any machinery attached to any mill, manufactory, or steamboat; or shall kill, wound, or disfigure, or administer any poison or noxious substance to any horse, ass,

mule, or neat cattle, with intent to kill, or injure the same, or shall injure any cloths in process of manufacture, shall, if such act is done wilfully, be fined not more than one thousand dollars, or imprisoned not more than six months, or both.

Sec. 8. Section 1222 of the general statutes is hereby amended to read as follows: Fires kindled by throwing down a lighted match, cigar, or other burning substance, shall be deemed within the provisions of sections 1220 and 1221, and every person violating any provision of said sections shall be fined not more than five hundred dollars, or imprisoned not more than six months, or both.

Sec. 9. Section 1237 of the general statutes is hereby amended to read as follows: Every person who shall, wilfully, and without color of right, cut, destroy, or carry away, any trees or timber of the dimensions of four inches diameter, or more, or any hoop-poles standing on the land of another, shall be fined not more than two hundred dollars, or imprisoned not more than ninety days, or both.

Sec. 10. The town and district fire wardens shall post such notices, containing the state laws concerning fires, as the state fire warden may prepare, and any person who wilfully or maliciously tears down or destroys any such notice shall be fined ten dollars.

Sec. 11. All acts or parts of acts inconsistent with the provisions of this act are hereby repealed.



THE EFFECT OF FOREST COVER UPON STREAM FLOW

PART II.

A STUDY OF DRAINAGE CONDITIONS IN THE CATSKILL MOUNTAINS

BY

W. B. GREELEY

Forest Assistant, U. S. Forest Service

IN the preceeding paper upon this general subject¹ it was strongly emphasized that forest cover must not be considered as an independent or isolated factor in its bearing upon stream flow; that it is rather but one of a number of far reaching, inter-related factors whose combined influence makes a stream's discharge regular or irregular; and that before any influence can justly be attributed to the forested or denuded character of a drainage basin the bearing of all of these other factors, precipitation, topography, geological conditions, must be carefully weighed. An attempt to approach the question in this manner was made by the writer in a study of two small tributaries of the Hudson, Esopus Creek and Wallkill River, under the direction of Mr. Newell, of the Reclamation Service. With the object of getting at the influence of all the factors which affect stream flow, a detailed comparison of the two drainage basins was made, covering the following points:

1. Precipitation, by weekly means.
2. Prevailing temperatures, by seasonal and annual means.
3. Topography.
4. Geological conditions.
5. The extent of forest cover and general forest conditions.
6. The character of flow of the two streams as shown by continuous discharge measurements made by the Division of Hydrography of the Geological Survey.

These two catchment areas were chosen for the study because they differ widely in the extent and density of their forest cover. Esopus Creek is well timbered, with not more than 15 per cent. of cleared land upon its entire basin. In the basin of the Wallkill, on the other hand, fully 85 per cent. of the land is cleared and under tillage, the remaining forest cover being confined to small, scattered woodlots. The object of the detailed comparison of the two streams, then, in the various respects noted above, was to determine first, as closely as possible, the probable effect of all the other factors, geology, topography, temperature, and rainfall, upon regularity of stream flow. Then, by directly comparing the flow of the two streams under daily measurement in the light of such influence, we should be able to judge whether or not the marked difference in the forested condition of the two basins has any effect upon stream discharge.

The results of this comparative study may be summarized briefly.

1. With regard to precipitation, practically no difference exists between these two drainage basins, either in total amount or in regularity of distribution throughout the year. As shown by records of the United States Weather Bureau, the mean weekly precipitation upon the Esopus basin for the period of three years covered in this study is one inch, and upon the Wallkill basin .97 inches. In each case the average deviation

¹ The Effect of Forest Cover Upon Stream Flow, Part I, General Factors Governing Stream Flow, FORESTRY AND IRRIGATION for June, 1905.

from the weekly mean, which expresses the regularity of precipitation, is about 78 per cent. As far then as this single factor is concerned, no difference between the two streams in regularity of flow may be expected.

2. The same similarity holds in the matter of temperature which has an important bearing upon stream flow through its influence upon evaporation. The seasonal and annual means are practically the same for the two drainage areas and no difference in stream flow can be attributed to this source.

The Wallkill basin is, in effect, a broad, rolling valley of very moderate slopes. This stream drains a region of non-resistant shales and limestones which have been eroded into a series of level, winding valleys, separated by low, gentle divides, 600 to 900 feet in height. The valleys follow the softer limestone areas, while the low divides mark the outcrops of harder shale. The average grade of slope of the entire basin is 6.68 per cent. and the average fall of the stream 10 feet per mile, two facts which summarize in themselves the undulating charac-



The Upper Wallkill Basin

3. With reference to the important factor of topography, however, marked differences are found in the two catchment areas. The Wallkill River of southeastern New York drains the valley region of the Appalachian belt, a region of old geological formations, worn down by prolonged erosion, and of low, rolling topography. Esopus Creek, on the other hand, drains the Catskill Plateau, a region of much more recent and less eroded geological structure and of steep and rugged topography.

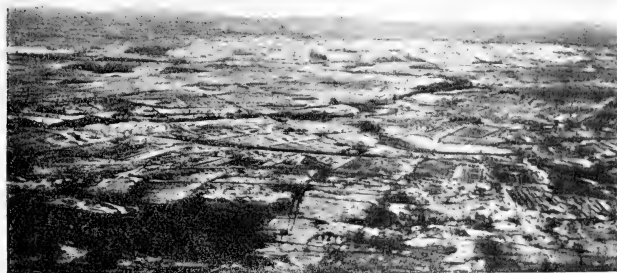
ter and gentle slopes of this watershed.

The catchment area of Esopus Creek, on the other hand, consists very largely of steep mountain slopes. The Catskill region, drained by this stream, is composed in the main of shales and sandstones of comparatively recent origin which have been sharply eroded into a series of high ridges separated by deep, gorge-like valleys. On many of the slopes the resistant rock is exposed as bare, outcropping ledges which often form a

series of terraces from base to summit. On the drainage basin as a whole the grade of slope averages 13.05 per cent. or double that of the Wallkill, and the fall of the stream 59.6 feet per mile, or nearly six times that of the Wallkill. These figures express in themselves the comparatively steep, rugged character of the topography of this basin.

In another important respect these two streams differ widely in topography. That of the Esopus is not only steep and rugged; it is simple and direct in character. The tributary

iate, lies in the facilities for storage by natural reservoirs. Natural reservoirs form a marked feature of the Wallkill basin. The undulating topography, together with the alternation of areas of soft limestone with more resistant shale, have led to the formation of swamps and ponds all over the drainage of this stream. Of special note are the "Drowned Lands" which impede the course of the river at its very source and line the channel of the main stream for many miles. On the entire Wallkill basin 42.52 square miles, or 5.04 per cent. of the



The Lower Wallkill Basin

streams are few in number, comparatively short, and direct in their course. The rolling valley of the Wallkill on the other hand is cut up into a series of long, winding, tributary basins, forming an extensive, complex drainage system with many secondary streams of gentle fall and sluggish current.

A third and still more striking difference in the topographic conditions upon these two basins, and one whose effects upon the character of stream flow are necessity, direct and immed-

total area, are occupied by lakes, ponds, or swamps. Natural reservoirs so well distributed and having so large a total extent, form a factor of prime importance in regulating the flow of the river.

The steep, rugged basin of the Esopus, on the other hand, is practically devoid of natural reservoirs. Swamps and ponds, forming no appreciable part of its entire area, are so limited as to have no effect upon natural storage.

The contrast in topography condi-

tions represented by these two streams may then be roughly stated as follows:

1. The slope of the Esopus basins are twice as steep as those of the Wallkill.

2. The fall of the Esopus is six times as rapid as that of the Wallkill.

3. The topography of the Esopus basin is much more simple and direct than that of the Wallkill.

4. The Esopus has no natural reservoirs, whereas a relatively large percentage of the Wallkill basin consists of swamps and ponds.

With regard to the bearing of these factors upon stream flow, it is evident that in each of these four important respects, the conditions upon the Wallkill basin are much more favorable to underground seepage and equable stream flow than on the Esopus basin. As pointed out in the general discussion of this subject, steep slopes such as those of the Esopus favor the immediate discharge of precipitation as surface run-off with but little underground seepage, while moderate slopes such as those of the Wallkill favor the slow and gradual discharge of precipitation with a maximum of underground seepage. A steep channel and simple, direct topography like that of the Esopus accelerate the discharge of flood waters from all parts of the drainage basin, causing sudden and rapid fluctuations in the flow of the main stream, while a channel of very moderate grade and winding, indirect tributary streams, like those of the Wallkill, have an exactly opposite effect. Of great importance also is the natural storage of flood water in swamps and ponds which we find in such marked degree on the Wallkill basin and which is lacking entirely in the basin of the Esopus. In all four respects, therefore, the Wallkill has a marked advantage over the Esopus in the natural conditions favoring evenness of stream flow. As far as the single factor of topography is concerned we would expect the Wallkill River to be much more reg-

ular in its behavior than the Esopus Creek. If this is not the case, it must clearly be due to the counter influence of some other factor governing stream flow.

4. The fourth factor with respect to which the two catchment areas are to be compared is that of geology. Of the Wallkill basin, fully 80 per cent. consists of Hudson River slates and corniferous limestones. The slate is moderately soft and resistant, approaching often a fine, flaky shale in texture. It forms as a rule the hills and low secondary divides of the basin. The limestone which is associated everywhere with the slate, forming usually the immediate basins of the streams, is soft, porous, and non-resistant to erosion.

These rocks have formed by disintegration deep layers of fine loamy and marly soils, supplying the basin with an excellent surface for absorbing precipitation and converting it into underground seepage. The large areas of soft, porous limestone, moreover, would tend to absorb directly large quantities of water, either storing it and yielding it up gradually to the surface, or allowing it to percolate through into underground water courses and channels of spring supply.

Of the Esopus basin, on the other hand, 90 per cent. consists of thick beds of sandstones, shales, and flags of the Catskill and Hamilton formations. In general these rocks are dense in texture, coarse grained, hard, and resistant to erosion. Their hard, resistant character is shown by the vertical cuts, sheer ledges and generally rough topography of the Esopus basin. The character of the mother rock, combined with the steepness of the mountain slopes, has resulted in the formation of a very thin layer of soil, the rock being at best scantily covered and in many cases entirely exposed. Not only is the absorbing layer of soil which plays such an important part in the storage of precipitation very thin over much of this

basin, but the rock itself from its dense texture and resistant character does not tend to absorb precipitated water but rather to shed it immediately as surface run-off.

In the bearing of geological conditions upon stream flow then, the Wallkill would seem to possess a marked advantage over the Esopus in its deep soil and large area of porous limestone. It is, of course, impossible to define closely the limits of such influence. In general, however, it is evident that, as far as the single factor

hand, the forests have been reduced, in the main to small, scattered woodlots occupying less than 15 per cent. of the entire basin. If forest cover exerts any real influence in equalizing stream flow, the forested Esopus should in this respect possess a marked advantage over the deforested Wallkill.

As between these two streams then the question limits itself to whether forest cover on the one hand or moderate topography, extensive natural reservoirs, and favorable geological



The Upper Esopus Basin

of geology is concerned, the flow of the Wallkill should be more constant and equable than the flow of the Esopus.

5. The marked difference between these two basins in the extent and uniformity of forest cover has already been noted. The headwaters of the Esopus and of all of its principal tributaries are covered by continuous and unbroken forest, including 85 per cent. of the total catchment area. In the valley of the Wallkill, on the other

conditions on the other exert the greater relative influence in storing precipitation and equalizing stream discharge.

This question can be answered by a comparative study of the behavior of the two streams under daily measurement. The discharge measurements of the two basins, made by the Division of Hydrography of the Geological Survey, were computed by weekly means for the three years from 1901 to 1903 inclusive. The

average weekly mean of each stream for the entire period was then obtained. The percentage deviation from this mean, above or below, for each week in the three years and the average deviation for the entire period were then calculated for each stream. The average deviation from the mean flow thus obtained should give us a ready means of comparing directly the variations of the two streams and

moderate topography, natural reservoirs, and favorable geological conditions of the Wallkill is somewhat stronger in promoting evenness of stream flow than the compact forest cover of the Esopus basin. At the same time the margin of difference between the regularity of the two streams is so small as to establish beyond doubt that the forest cover of the Esopus does exert a strong con-



The Esopus at Big Indian, N. Y.

the relative evenness and uniformity of their discharge.

It was thus found that the average deviation from the mean weekly flow is 78.24 per cent. in the case of the Wallkill and 83.69 per cent. in the case of the Esopus, the latter thus showing a slightly more irregular discharge than the former. The conclusion to which we are thus brought is that the combined influence of the

serving and regulating influence upon the flow of that stream. This is especially true when we recall how unfavorable the other factors of topography and geology upon that catchment area are to equable stream flow. The forest cover of the Esopus thus appears to overcome to a large degree the unfavorable effects of steep topography, hard and dense surface rocks, and marked deficiency in natural stor-

age facilities. It reduces the flow of that mountain stream to a regularity almost equal to that of a lowland type of stream where exactly opposite topography conditions prevail. That the deforestation of a mountainous basin like that of the Esopus must, therefore, greatly increase the irregularity of stream flow there can be no doubt. In other words, the compact forest cover of the Esopus has the same general equalizing effect as the moderate topography, natural reservoirs, and favorable geological conditions of the Walkill.

As far then as the investigation of these two basins will permit, a general conclusion may be stated as follows:

Conditions of temperature and precipitation being the same, the relative regularity of stream flow from different drainage basins will be determined

First, by the topographic and geological conditions and facilities for natural storage in swamps and ponds. This factor must be placed first as having the more general and far reaching importance.

Second, by the character and extent of forest cover. Forest cover, while secondary as a factor governing stream flow to the first named, exerts a very direct and powerful influence in moderating the effects of the first factor when unfavorable to equable stream flow, and in aiding and extending its influence when favorable.

THE RECLAMATION SERVICE

Progress of Government Irrigation in the Western States and Territories

Work on Salt River Project

The heavy rains and excessive and unusual spring floods in Arizona greatly retarded the work of the reclamation engineers, but during the month of May most of the damage to roads was repaired. Although the water had gradually subsided for several weeks, the flow of Salt River on June 2 was thirty times that of the same day last year.

Work has progressed rapidly despite the fact that until the latter part of May it was necessary to ferry all lumber from the mill and supplies for the mill near Livingstone. The capacity of the saw mill in connection with the Salt River project has been increased to nearly 11,000 feet per day, and the lumber is being moved to Roosevelt as rapidly as possible. Sixty teams hauling continually are required to keep up to the output of the mill.

Progress on the tunnel at the power

plant is being made at the rate of about 8 feet of finished tunnel per day. Cement manufactured at the cement mill has been furnished to contractors since the early part of May, and the quality of the output is very satisfactory. Work on the power canal has progressed slowly on account of scarcity of available men and teams.

During the past month a number of contracts for the purchase of land have been made, and the Secretary of the Interior has approved the purchase of other tracts.

A contour map showing the condition of underground water in the Salt River Valley was prepared this spring, and since the floods a new set of maps with contours representing the new position of the water plane has been drawn.

Reconnaissance surveys of Pinto Creek and the San Carlos project have

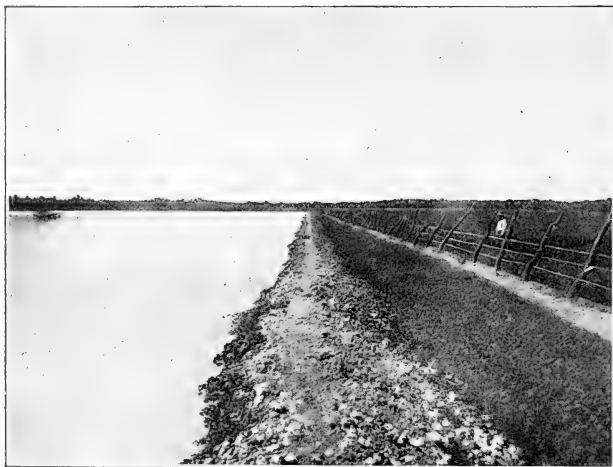
been made, and estimates of power canal tunnels and concrete structures have been made in the office.

The Kremmling Reservoir Site

In reply to questions regarding the Gore Canon, Mr. F. H. Newell, chief engineer of the Reclamation Service, stated that this matter was one among a large number of important questions which had come to his notice in connection with reservoir sites in the various parts of the United States. The information attained leads to the belief that this reservoir site is unique

fit to Colorado.

As regards the railroad right of way, this matter has been fully discussed before the department at Washington, hearings being had by the Assistant Attorney General, and all of the evidence presented by the railroad has been given careful consideration. As a result of a study of the evidence presented and of the arguments offered by the railroad, the Secretary of the Interior has concluded that it is his duty to protect the irrigation interests and has referred the matter to the Department of Justice.



Colorado River Overflow below Yuma, Arizona

in that there is a very large storage capacity combined with economy of construction of the dam and a large volume of water available for storage.

The study of the entire drainage basin of Colorado River shows that it will be necessary to utilize the Kremmling reservoir site in the development of arid lands in Colorado and further down along the stream. The flow of Grand River at Grand Junction drops in summer to an amount below the needs of the irrigable lands in the vicinity, and the construction of the reservoir will be of great bene-

An analysis of the facts presented leads to the belief that a suitable railroad location can be found without destroying the Kremmling reservoir. If the reservoir were already built there is no question but that the railroad would find a way around it and would not contend that the existence of the reservoir blocked railroad development.

In short, the following contentions are believed to be susceptible of proof when the proper time arrives:

First—That a feasible route for the railroad exists avoiding the reservoir

and the dam site in Gore Canon.

Second—That public interest demands that the government shall not sacrifice the Kremmling reservoir on the facts presented.

Third—It is simply a question of time when the railroad and the reservoir will be built and successfully operated, giving Colorado the advantage of all natural resources without depriving the public lands along the Grand and Colorado Rivers of the needed quantity of water.

The matter being now in the hands of the Department of Justice it is not

be used to the most complete extent in irrigation development in Colorado and elsewhere.

The value of the Kremmling reservoir site was recognized, as the results of surveys demonstrated the impracticability of storage elsewhere. The careful studies of the entire situation made by Mr. A. L. Fellows brought forward clearly the necessities for holding the Kremmling site. His efforts on behalf of the public interests are very highly appreciated by the government officials and too much cannot be said in praise of the con-



Colorado River Annual Inundation

permissible for the engineers to discuss the details or the evidence presented. The government has already spent large amounts of money in surveys and explorations along the Colorado River and its tributaries, and is now engaged in expensive construction work on the lower river, the success of which depends largely upon the utilization of the Kremmling reservoir. Steps have been taken to protect the rights of the public in this reservoir in order that its waters may

scientific attitude take by Mr. Fellows in his advocacy of the best public interest of the State of Colorado. Although not now connected with the Reclamation Service, Mr. Fellows' judgment and opinions on matters concerning the water supply in the State of Colorado are accepted as of the highest value and his services for the state and government are known to be those of an unusually conscientious, far-sighted engineer.

North Platte Project

A recent visit of representatives of the Reclamation Service to the North Platte project in Nebraska-Wyoming shows that the situation is quite encouraging.

Contracts for the first section of the canal for a length of about 45 miles have been awarded by the Secretary of the Interior and the contractor expects to begin work at once.

The people themselves are now very actively perfecting the organization of the Water Users' Association in order that they may cooperate with the United States Government in the working out of the project.

A local difficulty has arisen which, however, will not interfere with the progress of the government. This involves two questions: (1) Whether the government has a right to water its own lands which happen to be situated under the canal proposed to be constructed by private parties as an extension of the old Farmers' Canal, no construction having been begun by them during the eight years since they first placed their plans of record under the local statutes; (2) Whether the government can furnish water to lands in private ownership under this same proposed canal extension.

These are questions of law which are now before the courts, and will be settled between the United States Government and the parties claiming rights under the old canal location.

As the matter is one between the United States and those proposing to construct this canal, it will not prevent those owning the lands under the proposed canal from applying to the government for water rights. If the courts should hold adversely to the rights of the government to furnish water for these lands, all contracts which have been made with the government will necessarily be cancelled, and the parties who have made application for water will be left in no worse situation than they were before.

With this understanding, those par-

ties who are affected by this phase of the question are arranging to join the Water Users' Association, which is to be recognized by the government as the representative of the water users, and will make application to the United States for water rights when announcement shall be made that the government is ready to receive them. The adjustment of the legal questions will be left to the courts.

The people in general are enthusiastically in favor of the government project, and all land owners in the valley are preparing to become members of the Water Users' Association, including nearly all of those under the proposed extension of the Farmers' Canal.

To Reclaim Alkali Lands

An interesting and important investigation is being carried on by the Reclamation Service, to determine the best method of reclaiming the alkali lands under the Truckee-Carson project, Nevada.

The plan entails the installing of ten acres of alkali land—typical in texture of the general farm lands now being entered by farmers—with under drains, for the purpose of leaching out the alkali, and the preparation of another ten acres of land for flooding copiously with water, without under drains being previously laid. It is intended that the work on the first ten acres will demonstrate the advisability of reclaiming alkali lands with under drains, and determine the approximate cost for such work per acre. The work on the second ten acres should determine the possibility of reclaiming these lands from alkali without under drains being previously laid. The lands selected are not only typical farm lands met with in this, but in other projects, and are threatened with alkali accumulation.

The data collected will be of value to the farming interests in that the results will demonstrate the best process for handling farm lands which are too salty for profitable cultivation, and which are met with in several parts of

the arid region. In connection with the drainage systems installed by the engineers on the project, it will offer valuable information relative to the efficiency of such drainage systems.

Beside the two tracts above mentioned, land has been selected for the installation of under drains on a third ten acre tract. This selection represents typical alkali conditions for the heavy adobe lands lying in large bodies in the flats of the Truckee-Carson project. Should it be found possible to reclaim these lands at a reasonable cost, it is believed that the land available for farm entry under this project would be increased by many thousand acres.

This investigation is of great importance from a financial standpoint, in that a comparatively small cost per acre for relief from alkali may make possible the reclamation of large bodies of land under the system, which are now unfit for cultivation.

Drainage conditions are also being studied in connection with the Klamath, Minidoka and Huntley projects, and work on soil classification is being generally carried on throughout the field of operations of the service.

Assistance Asked in Southern California

A copy of the preamble and resolutions adopted by the San Diego Chamber of Commerce, California, at a recent meeting of that body, has been forwarded to the Director of the U. S. Geological Survey by Senator Perkins.

These resolutions deal with the question of water resources of the western slope of San Diego county, and recite that extraordinary opportunities are afforded for the storage of flood waters. So erratic are the courses of the streams of that section, so much do the watersheds overlap, that it is the sense of the board that a solution of the water supply problem can only be solved by a united irrigation system, planned as a whole and yet so arranged that each district can be formed separately, although

remaining a part of the whole. A request is made that the engineers of the Reclamation Service be assigned to the duty of ascertaining the facts in the case.

The enthusiasm and persistence of the citizens of California in developing their state through irrigation is a source of inspiration. Except in certain localities there is not in California the absolute necessity for irrigation that exists in most Western states and territories. On nearly all the irrigated lands of the state some crops will grow without the artificial application of water, yet the irrigation systems of California are known all over the world. Southern California leads the United States in the scientific and diversified methods of distribution, application and development of water supplies, and in the expensive character of its irrigation works.

That the citizens of that state appreciate the work of the Reclamation Service is evidenced in their desire to cooperate in every possible way, and in the great number of petitions and resolutions which are being constantly received.

Bismarck Project Delayed

The indifference displayed by the land owners has greatly delayed the progress of the Bismarck irrigation project, and their apparent lack of interest is jeopardizing the entire work.

It is necessary before construction can begin to obtain an agreement from the land owners to abide by the conditions of the Reclamation law in regard to the subdivision of the land and the repayment of the actual cost of irrigation to the reclamation fund. Any further delay in forming a water users' association will make it necessary to withdraw the field parties and transfer operations to other projects for the present at least.

The Secretary of the Interior provisionally set aside the sum of \$550,000 for the construction of the Bismarck project, and plans have been under consideration for greatly extending

the irrigable area by the erection of a central power station convenient to the coal supply, transmitting the power electrically to pumping plants farther down.

An enormous increase in property values and the insurance of good crops every year would result from the construction of this work, and it would be a matter greatly to be regretted if continued neglect on the part of the land owners to embrace their opportunities should make it necessary to transfer operations to other localities.

Progress on the Shoshone Works

High water in the river has interfered materially with work on the Shoshone project, Wyoming, this spring, and necessitated moving the main camp to higher ground. Borings at the dam site in Shoshone Canyon and along the line of the Corbett diversion tunnel have been practically completed, surveys for the final location of the canal between the tunnel and Ralston made, and road grading above the main dam begun.

It is proposed to complete work on the wagon road through Shoshone Canyon at an early date and construct the temporary buildings at the Corbett diversion dam site. A telephone system consisting of about six miles of line will greatly facilitate the work. Topographic surveys of irrigable land will be carried on during the summer and final location of canal lines made.

Borings along the line of the diversion tunnel on the south side of the river will be commenced in a short time, and it is hoped that the preparation of farm unit maps may be made during the summer.

Poor Postal Facilities Delay Work

Engineers of the Reclamation Service at Glendive, Montana, are experiencing much inconvenience and delay in the work on the Fort Buford project, by reason of the inadequate mail facilities, and a postoffice inspector has been looking over the situation.

It is deemed advisable that a post-

office be established at Neil Stewart's ranch, which is on the stage line 20 miles from Glendive and one mile from the headworks, where a permanent camp is established, and that the mail service between Glendive and Mondak be improved.

At present it takes a week to send mail to Mondak and get reply, a distance of 50 miles, and a great deal of business is carried on at that point. The service to Glendive is also exceedingly bad.

The contractors will have large camps in the vicinity of the Stewart ranch, and several families would also get their mail there. The matter has been taken up with the department, and it is hoped that satisfactory arrangements will be made in the near future.

Bids Opened and Contracts Let

Bids for the construction of Laguna dam, Yuma project, California, were publicly opened at the office of the Reclamation Service, Los Angeles, California, at 2 p. m., on June 5, 1905. Eight regular bids were received, as follows:

J. C. White & Co., New York City, \$797,650.00.

Burrell Const. Co., Oakland, Cal., \$799,550.00.

P. McDonnell, Duluth, Minn., \$823,660.00.

City Street Imp. Co., San Francisco, Cal., \$829,519.50.

Cotton Bros. & Co., Oakland, Cal., \$847,675.00.

R. W. Faris, Boise, Idaho, \$862,000.00.

Pacific Const. Co., San Francisco, Cal., \$866,560.00.

N. S. Sherman Machinery Co., Oklahoma City, Oklahoma, \$1,030,117.50.

These bids have been transmitted to the Secretary of the Interior for his consideration.

The project board recommended the construction of a dyke as a part of the irrigation and reclamation works. This dyke is believed necessary for the diversion of the flood waters of the Colorado River from the irrigable lands in

Yuma Valley, it being in effect a prolongation of the Laguna dam for diverting such flood waters from such lands.

As a result of the above recommendation the Secretary of the Interior has advertised for proposals for the construction of about 12 miles of dyke, involving the excavation of about 445,000 cubic yards of earth, and clearing 125 acres of land. Specifications, forms of proposal and plans may be obtained from the Chief Engineer of the Reclamation Service, Washington, D. C., from the Supervising Engineer, Los Angeles, California, and from the Engineer of the Reclamation Service, Yuma, Arizona.

These bids will be received at the office of the Supervising Engineer of the U. S. Reclamation Service, at Los Angeles, California, until 2 o'clock p. m., August 17, 1905.

The Yuma project is one of the most interesting undertaken by the government up to the present time, involving as it does an extensive system of drainage and levees, unique engineering features for the disposal of silt, and a tunnel to carry the irrigating water under the bed of the Gila River. The engineers have under consideration a plan to install pumps for lifting water to 25,000 acres of exceedingly fertile mesa land southeast of Yuma. Three million dollars have been set aside for the construction of the works, and it is estimated that 85,000 acres can be reclaimed thereby.

A special act of Congress was necessary to authorize the construction of the Yuma project on the lower Colorado River, as this river is a navigable stream, and complicated international questions were involved.

The bottom lands are of great fertility, having been enriched for centuries by the silt washed down from the mountains by the Colorado River. The mesa lands are particularly adapted to the cultivation of early fruits, including the citrus varieties, and early vegetables. Probably the earliest veg-

etables in the United States can be furnished from these mesa lands when properly irrigated. On account of the possibilities of intensive cultivation the farm units probably will be forty acres.

The Secretary of the Interior has executed a contract with the Gila Valley, Globe and Northern Railway Company whereby the above named company agrees to make special freight rates on material and machinery to be used in the construction of irrigation projects under the act of June 17, 1902 (32 Stat. 388).

These reductions in freight rates are made in view of the fact that the government irrigation systems on or tributary to the lines of the railroad company will be of great benefit to the country traversed by those lines, and to all parties doing business therein. The money thus saved will be covered into the reclamation fund and will reduce the cost of construction and promote the development and settlement of the lands under the project.

Bids for the construction of the distributing system of the Minidoka project, Idaho, and also for a pole line and telephone system in connection with the same project, were opened at Boise, Idaho, yesterday. The lowest bids for sections of the distributing system, which consists of about 21 miles of main canals and 102 miles of branches and laterals, were as follows:

Orman & Crook, Pueblo, Colo., schedules 1, 5, 6, and 7.

Hubbard & Carlson, Boise, Idaho, Number 2.

Monarch & Porter, Des Moines, Iowa, schedules 3 and 4.

Vulcan Iron Works, Chicago, 8. Total of lowest bids, \$680,000. Fourteen bids were received.

The lowest bids on the pole line and telephone system was that of Crumb & Co., of Iowa—\$6,335.

The Secretary of the Interior has executed a contract and approved the bond of James O'Connor for the construction and completion of division 8 of the Interstate canal, North Platte

project, Nebraska. This division consists of 4 miles of canal.

Six bids were received by the Reclamation Service for the construction of outlet and regulating works and bridge at the outlet of Lake Tahoe, California, in connection with the Truckee-Carson project, Nevada, and the Secretary of the Interior has awarded the contract to Mr. Edward Malley, of San Francisco, whose bid, \$32,200, was the lowest.

Some misapprehension seems to exist in the minds of certain riparian owners as to the effect of these works on their property. The work as outlined is designed to utilize the lake between high and low water levels as they have been known to exist for many years, and the plans involve a regulation of the lake within a limit of six feet, which is within the range of seven feet five inches, the natural fluctuation as shown by actual measurements. The natural beauties of the lake will not be interfered with, and it is not the purpose or intention of the engineers to interfere with private rights along the lake shores.

The Secretary of the Interior has awarded contracts for the construction of canals, branches and structures, and telephone system, in connection with the Minidoka project, to the lowest bidders, as follows:

Telephone system, W. H. Crumb & Co., Chicago, Ill., \$6,335.

Schedules 1, 5, 6 and 7, canal and bridge work, Orman & Crook, Pueblo, Colorado, \$354,823.02.

Schedule 2, 34.3 miles of branches and laterals, Hubbard & Carlson, Boise, Idaho, \$121,494.00.

Schedules 3 and 4, 43.3 miles branches and laterals, Monarch & Porter, Des Moines, Iowa, \$194,836.75.

Schedule 8, cast iron and steel in gates and lifting devices, Vulcan Iron Works, Chicago, Ill., \$9,471.18.

Five bids were received for the construction of the telephone system, and on canals, branches and structures fourteen bids were received.

Bids Wanted by Department of Interior

The Secretary of the Interior has advertised for proposals for the construction of a group of six frame buildings at Wyncott, Wyoming, in connection with the North Platte project. These buildings are to be used as headquarters of the U. S. Reclamation Service and will consist of residence for the project engineer, main office building, dormitory, mess house, stable, and offices of resident engineer.

The site was donated by residents of Wyncote and is located about half a mile from the railroad station.

A board of consulting engineers of the U. S. Reclamation Service held a meeting in May and recommended plans and specifications for about 8 miles of the South canal, Uncompahgre Valley project, and the Secretary of the Interior has advertised for bids for its construction. The building of this distributing canal will involve the excavation of 525,000 cubic yards of material and the placing of 20,000 cubic yards of concrete masonry for the conveyance and partial distribution of 1,300 cubic feet of water per second from the mouth of Gunnison Tunnel, near Cedar Creek, to a point on the Uncompahgre River 9 miles south of Montrose, Colorado. The bids will be received at the office of the U. S. Reclamation Service, Montrose, Colo., until Aug. 28, 1905.

Surveys have been made covering the uncompleted work necessary for the East and West canals and the South canal is nearing completion. The office building at Montrose will be erected during the summer. Since the Taylor-Moore Construction Company relinquished their contract on the Gunnison tunnel on May 27, the work has been carried on by force account, but revised plans and specifications are being considered for the reletting of the tunnel contract.

The Secretary of the Interior is advertising for bids for furnishing 600,000 pounds of square steel bars for use

in connection with the Fort Buford project, North Dakota and Montana. These proposals will be received at the office of the engineer of the U. S. Reclamation Service, Glendive, Montana, until August 21, 1905.

Bids were opened on June 1st for the construction of the headworks and 34 miles of canal, together with the necessary conduits, spillways, sluiceways, and other structures, and also for 70 miles of telephone line. A contract between Lower Yellowstone Water Users' Association and the Secretary of the Interior has been signed by the president and secretary of the Association and will soon be submitted to the department.

Field parties are at work revising and cross sectioning the 34 miles of canal line preparatory to construction, and other parties are locating the lateral system. A soil survey is being made with a view of determining the farm units. As soon as the location of the lateral system has reached a point where plans and specifications can be drawn, bids will be asked for its construction, and a dam across Yellowstone River will be advertised at about the same time.

As much of the land to be irrigated by this system lies on the benches about 90 feet above the river, it will be necessary to raise the water in the river about 5 feet at the headgates by means of the diversion dam. At the point of diversion, about 19 miles north of Glendive, Mont., the river is rather shallow and has suitable foundations for a low dam, which will be so located as to permit the canal to be taken out in a tunnel, thus placing the headgates where they will be protected from the shock of large ice gorges which cause considerable damage along the river every few years.

This project is surrounded by one of the finest and largest grazing regions in the West. The stock requires feeding three months of the year, and the quantity of feed available determines the amount of stock that can profitably be raised. With this tract of land irrigated and alfalfa and other forage crops extensively

grown, this will be one of the largest stock feeding points in the West.

The Secretary of the Interior has advertised for proposals to furnish from twelve to sixteen thousand barrels of Portland cement for the Fort Buford project, North Dakota and Montana.

The bids will be received at the office of the Engineer of the U. S. Reclamation Service at Glendive, Montana, until July 31, and particulars may be obtained by application to the Chief Engineer, U. S. Reclamation Service, Washington, D. C., or to F. E. Weymouth, Engineer, U. S. Geological Survey, Glendive, Montana.

Bids for the construction of the Pathfinder dam, in connection with the North Platte project, Wyoming, were opened at Denver June 16, and the lowest bid was found to be that of W. C. Bradbury—\$364,940.

The Secretary of the Interior has also advertised for bids for the construction of a pile bridge 350 feet long across the North Platte River, about 25 miles southwest of Casper, Wyoming. Cement and other material for the dam and related works are to be delivered at Casper, and the proposed bridge is on the shortest route by 10 miles between that point and the Pathfinder dam.

The route by the bridge passes through a country where feed for stock is grown, so that feeding stations can be established at points along the road without the expense of hauling fodder a great distance. There is also a telephone line in operation along the route which will soon be extended to the dam site, and the road is in a condition to be easily repaired. The Chicago and Northwestern Railroad and the County Commissioners of Natrona county have signified a willingness to make the needed repairs.

The direct advantage which will result from the construction of the bridge and the consequent shortening of the route over which cement and supplies must be hauled, should materially reduce the cost of the dam.

THE FOREST SERVICE

Outline of Work Now Being Carried on by Federal Government in Various Sections of the Country

Regulation of Forest Reserves

Mr. Gifford Pinchot, Forester, U. S. Department of Agriculture, has completed a draft of regulations and instructions for the use of forest reserves, which has been approved by the Secretary of Agriculture. The regulations recently issued went into effect July 1, 1905.

The first paragraph declares:

"Forest reserves are for the purpose of preserving a perpetual supply of timber for home industries, preventing destruction of the forest cover which regulates the flow of streams, and protecting local residents from unfair competition in the use of forest and range. They are patrolled and protected, at government expense, for the benefit of the community and the home builder."

Another section of the regulations announces that:

"The administration of forest reserves is not for the benefit of the government, but of the people. The revenue derived from them goes, not into the general fund of the United States, but toward maintaining upon the reserves a force of men organized to serve the public interests. This force has three chief duties: To protect the reserves against fire, to assist the people in their use, and to see that they are properly used.

"Forest officers, therefore, are servants of the people. They must obey instructions and enforce the regulations for the protection of the reserves without fear or favor, and must not allow personal or temporary interests to weigh against the permanent good of the reserves; but it is no less their duty to encourage and assist legitimate enterprises. They must answer all inquiries concerning reserve methods fully and cheerfully, and be at

least as prompt and courteous in the conduct of reserve business as they would in private business.

"They must make every effort to prevent the misunderstanding and violation of reserve regulations by giving information fully and freely. The object should be to prevent mistakes rather than to have to punish those who make them. Information should be given tactfully, by advice, and not by offensive warnings.

"Forest officers will be required to be thoroughly familiar with every part of this book, and to instruct the public and assist in making application for the use of the reserves."

Special Privileges in Forest Reserves

The new regulations for the use of forest reserves, noted above, contain the following rules governing special occupancy privileges:

Hotels, stores, mills, summer residences, and similar establishments will be allowed upon reserve lands wherever the demand is legitimate and consistent and convenient with the best interests of the reserve.

The use of tracts not to exceed two acres for schools and one acre for churches is specifically provided for by law, subject to regulation by the department and any other disposition of the land by the government. Timber for the construction of church and school buildings may be secured under the free use and sales regulations.

Application for special occupancy privilege must be made to the supervisor, who will transmit it, with report and recommendation, to the forester. The forester may approve the application, with such restrictions as to area, time, terms, and surety as he may deem best, and may extend or renew any permit in his discretion.

Wagon roads and trails may be constructed, changed, widened, extended, or repaired upon forest reserve lands when needed, but permit or right of way must first be secured. Permits will not give the right to exclusive use, or to charge toll, or against future disposal of the land by the United States. Applications must be made directly to the supervisor or through a ranger; never to the Washington office.

Permits for canals, ditches, flumes, pipe lines, tunnels, dams, tanks, and reservoirs, not for mining or municipal purposes, nor granting an easement, are under the jurisdiction of the Secretary of Agriculture and should be applied for to the supervisor, as in the case of roads and trails.

If the project is small and of a private and personal character—such as a reservoir, pipe line, or ditch to supply a few farms, or a tank to collect water for stock—and the supervisor is certain that there are no complications of title, nor prior and conflicting rights, he may approve the application. If any large or commercial enterprise is involved, or if there is any question of conflicting rights or of the jurisdiction of the United States over the land, or of conflict with Federal, State, or Territorial laws controlling use and appropriation of water, the supervisor must transmit the application to the forester for approval, together with report and recommendation.

Permits for private railroads and tramroads and telegraph, telephone, and power lines may be granted only by the forester. Applications may be made to the supervisor in the manner prescribed for road and trail applications. Accurate map of the proposed line must be supplied by the applicant.

Studying Iowa Planted Groves

The plan for the study of planted groves in Iowa, which is to be undertaken this season, has been prepared. The work will be carried on in coöperation between the Bureau of Forestry and the Iowa State College. The field operations will be under the direction of the forester of the Agricul-

tural Department of the College. These investigations will be made to determine on the basis of existing groves the best species and best cultural methods for the region covered. The field party will consist of five men, who will travel in wagons over a carefully planned route. Many hundred typical groves will be visited and measurements taken as to the rate of growth and yield of the various plantations. Species will be studied as to their behavior when planted alone or in mixture, and careful consideration will be given the economic value of each. To make the study of the region complete certain small bodies of natural timber found along these natural groves can be depended upon to supply the local needs, and as to the suitability of the native species for planting. The value of forest plantations to the farmers of Iowa for the purposes of protection and fuel supply is thoroughly appreciated, and this investigation is receiving every encouragement from the people of the region.

Creosoting Telegraph Poles

The Bureau of Forestry has attained great success at Dover, N. J., in impregnating the butts of telegraph and telephone poles with creosote. A tank designed by the Bureau is used, in which the poles are placed at an angle of about 20 degrees. This allows the creosote to cover about 10 feet of the pole. The poles are boiled in the creosote for several hours, and then transferred to similar tanks filled with cold creosote, where they remain about the same length of time. It is found that the creosote penetrates the wood a half inch or more, and the absorption per pole is 35 to 40 pounds. The treatment will undoubtedly double the natural life of the pole. Creosote is expensive, and this plan is much cheaper than to impregnate the whole pole with about 250 or 300 pounds, as has been done. As the entire value of the treatment is reached when about 8 feet of the pole is preserved, the value of this work by the

Bureau is apparent. The work will be completed this week at Dover, but will be continued for the next two weeks at Thorndale, Pa.

Example of Profit in Forestry

The Medicine Bow Forest Reserve in Wyoming is furnishing a good example of what can be done by practical work in the national forests. The reserve was created about three years ago, and in the last two years the cash receipts for timber have been \$25,449.61. Another sale of \$10,000 worth of timber is just being completed. The timber is largely lodgepole pine with some Englemann spruce, and it is being cut for railroad ties, mine props, and a little for lumber. The supply in this reserve is very large, and with judicious management may be made continuous. The present cutting is only a proper thinning of the forest, taking trees that can well be spared, and the condition of the forest is being improved. All the cutting has been done by the same contractors and the work has been of the highest character. There has not been the slightest friction in the enforcement of government cutting regulations, nor has there been a day's delay in the payment for timber sold.

Tree Planting in Southern California

The annual report on the forest planting operations which the Bureau of Forestry is carrying on in the San Gabriel Mountains of southern California has reached Washington. It shows very satisfactory progress in all lines. The heavy rains the past season and the large supply of nursery transplants made possible the first extensive planting on the chaparral slopes. In all 35,700 trees were set out. To demonstrate the suitability of various trees, fourteen different species were used, which were set in different types of chaparral growth at altitudes ranging from 2,000 to 2,500 feet. These trees are in good condition and have already started growth. The size of the lath house at the Henninger Flats nursery was increased

one-third, giving 11,520 square feet of seedbeds. This space was sown to seeds this spring and has a capacity of 300,000 one-year-old trees. The seedlings grown in the seedbeds last year were transplanted to nursery beds in open ground in March. The total number transplanted was 210,700, and consisted of ten important species, the most promising of which for mountain planting are big-cone spruce, Coulter, knob-cone, and western yellow pine, and incense cedar. The report shows an increasing public interest in the matter of reforestation and protecting the important watersheds of California. Business men are giving more thought to the subject and it is a matter of discussion in many conventions and public meetings. The Los Angeles Chamber of Commerce has this year contributed \$1,500, and the Pasadena Board of Trade \$500 towards the reforestation work in the San Gabriel Mountains.

Free Use of Timber and Stone

Regarding the free use of timber and stone, the new regulations for use of the forest reserves contain the following statements:

The law gives the Secretary of Agriculture discretion to allow or refuse the free use of forest reserve timber and stone, under such regulations as he may prescribe, by "bona fide settlers, miners, residents, and prospectors for minerals, for firewood, fencing, building, mining, prospecting, and other domestic purposes as may be needed by such person for such purposes; such timber to be used within the state or territory, respectively, where such reservations may be located, and by the United States."

The free use privilege may be granted to settlers, farmers, prospectors, or similar persons who may not reasonably be required to purchase, and who have not on their own lands or claims, or on lands controlled by them, a sufficient or practicably accessible supply of timber or stone for the purposes named in the law. It may also be granted to school and road

districts, churches, or coöperative organizations of settlers desiring to construct roads, ditches, reservoirs, or similar improvements for mutual or public benefit. Free use of material to be employed in any business will be refused, as, for example, to saw-mill proprietors, owners of large establishments or commercial enterprises, and companies or corporations. The free use privilege will not be given to any trespasser.

Except in cases of great and unusual need, no applicant will be given more than two free use permits in one year, nor may the aggregate amount of material granted in the two permits exceed \$20 in value, except in the case of schools or road districts, churches and non-commercial coöperative organizations, when the supervisor may, in his discretion, extend the amount to any value not exceeding \$100. The duration of any permit will be fixed by the issuing officer, and will not exceed six months. In cases of unusual emergency, however, it may be extended by the supervisor, or, if for \$20 or less, by a ranger authorized to grant free use.

Wood for Street Paving

On account of the increasing interest in wood as a material for street pavements the Bureau of Forestry will at once make a thorough study of American woods for that purpose. The experience of European and Australian cities indicates that wooden pavements properly laid are superior to such pavements as asphaltum and macadam, in the particulars of coolness, quietness, safety of footing and sanitary qualities.

The sanitary advantages are apt to result only when the wooden blocks are thoroughly creosoted, and in laying are filled in between with creosote and tar. The sanitary influence of creosote is widely known. Its value as a wood preservative is dependent upon its antiseptic and insoluble properties. With wood which has been thoroughly creosoted decay is practically eliminated. The creosoted wood-

en pavement would therefore not prove by any means a hospitable place for disease germs of any kind.

The woods used with the best results for paving in the past have been Australian hardwoods. American woods have not had a wide test in thoroughly well laid pavements. One American hardwood, the red gum, has been tried quite extensively in England with very satisfactory results. There are unquestionably many American woods just as valuable for pavements as any of the Australian hardwoods. The woods which especially commend themselves for paving purposes are northern hardwoods, such as birch, beech, and maple, of which there is a large supply and for which, up to this time, there has not been a ready market. If these woods prove satisfactory their advantage over Australian hardwoods in point of cheapness for use in the United States, will be readily seen. In its investigation the Bureau of Forestry will give its first attention to these woods.

Private and State Rights in Reserves

The new regulations for the use of forest reserves contain the following rules as to private and state rights in the reserves:

Persons having valid claims under the public land laws, or legal titles to land within forest reserves, are free to occupy and enjoy their holdings, but must not interfere with the purposes for which the reserves are created, and must not cut timber or make use of forest reserve land or rights thereon without a permit, except within the limits of their claims, and there not to the extent of committing trespass.

All questions involving titles to such claims are entirely within the jurisdiction of the Secretary of the Interior.

No land claims can be initiated in a forest reserve except mining claims, which may be sought for, located, developed, and patented in accordance

with law and forest reserve regulations.

Lands owned or claimed by the states or territories within forest reserves are subject to the general rules given above. Indemnity selection may be made by the states and territories for school sections 16 and 36, when within a reserve, and thereupon these sections will become part of the forest reserve.

No right now exists to exchange private holdings within forest reserves for lands elsewhere, except where such right was established in the Interior Department before March 3, 1905, and except the indemnity-selection right with regard to school sections 16 and 36, referred to above.

Will Extend Study of Forest Plantations

The Bureau of Forestry has planned to extend the scope of its study of forest plantations during the coming season. A large amount of forest planting has been done, especially by various railroad companies with varied success. In many cases the plantations have been failures because they were not planted under expert direction; others through unwise choice of species, too wide spacing, and lack of cultivation have not attained high value. The scheme of the present work is to accumulate all available data regarding railroad plantations and failure, the species which are best suited for railroad planting in different regions, and in short to acquire the data which will enable the Bureau to perform the highest advisory function along all lines of forest planting. The location of existing railroad plantations will be determined through correspondence, and data compiled as to the yield and general character of species already used or which can be recommended, and a field study will be made of the more important plantations in representative regions. The furthering of railroad planting will not only be a step toward insuring a future supply of ties, but will encourage planting by farmers and ranchers

along the railroad lines where large plantations are established.

Examine Potomac Water Shed

The Forest Service has just started, in cooperation with the Geological Survey, a study of the conditions of the watershed of the Potomac River and its tributaries. The general plan will include a determination of all causes of contamination, as from industrial and domestic sources and because of bare and eroded watersheds. The Forest Service is specially concerned with the last feature.

The tributaries of the Potomac will be critically examined in Virginia, Maryland, West Virginia, and probably in Pennsylvania. Slopes bare, partly cleared, and timbered will be studied, the run off after rains will be compared, and the influence of forest cover in equalizing stream flow investigated. The purpose is to find out and lessen, if possible, the amount of solid matter carried down the river during times of freshets. In this way material aid will be given future filtration of the water for domestic purposes. Mr. W. W. Ashe will be in charge of that part of the study conducted by the Forest Service.

Bids for Reserve Timber

The Forest Service has received an offer of \$2.50 a thousand feet for 50,000,000 feet of lodgepole pine and Engelmann spruce in the Big Horn Forest Reserve, Wyoming. The timber will be advertised for sale and this bid accepted if none higher is made. This means at least \$125,000 for this timber, which will be used largely for railroad ties and mine props.

Hitherto sales of timber in that region have been of small quantities and strictly for local use, and \$1 a thousand feet has been the average price received. The recent congressional enactment permitting, with two exceptions, the export of timber from the state where the reserve is located, makes possible such large sales as the present. It also materially helps the price of government timber.

This 50,000,000 feet will be cut strictly under the new regulations of the Forest Service, which means in such a way that only the dead and mature timber will be used, that the forest will be protected from fire, and the seed trees and young growth guarded so that the future productivity of the forest will be assured. Unless this sale were made, much of this timber would die and disappear, without benefit to the government or any one else.

Kiln-Drying Lumber

The Forest Service is beginning a study of the methods and results of the kiln drying of lumber. This has been a perplexing question, both to the manufacturers and dealers in lumber, and some kinds of timber have been found exceedingly difficult to season by ordinary kiln-drying methods. There is also little definite information as to what degree of dryness is attained under ordinary methods, and exactly what the influence of the process is on the quality of the lumber.

In connection with the field study, there will be made at the New Haven laboratory of the Forest Service a very careful series of tests of the effect on timber of seasoning under different conditions, such as through air seasoning, through dry heat, and through steam. It is expected that this study will do much towards putting the kiln-drying of lumber on a definite scientific basis.

Basket Willow Culture

An interesting development in connection with the investigation which the Forest Service is conducting on the basket willow culture is the flooding of its willow holts for the purpose of destroying such insects injurious to willow as pass a portion of their lives in or near the ground. The Service has an extensive plantation of standard strains of basket willow, the yield and utility of which is being tested under different systems of culture. A number of the most promising varie-

ties are attacked from time to time by various willow insects, greatly damaging the fine commercial quality of the rods. Widespread injury of this kind has already prevented the profitable growth of the best kinds of basket willows in many sections of the United States, particularly in the South. A part of the government willow plantation has just been surrounded by a specially constructed dike which will permit the flooding of the ground for any length of time required to destroy insects in or near the ground. It is proposed to turn water upon the affected willows at a time when the insects are near the roots of the plants. This means of control does not apply to all of the willow insects which pass all of their lives above ground on or in the twigs. Certain species, however, go to the ground or into it for transformation, and others hibernate in or near the ground. It is expected that winter flooding will destroy the latter, and it is hoped that seasonable summer floodings will destroy many of the former.

Studying Loblolly Pine

The importance of the export trade in loblolly pine and the need of presenting accurate information to the foreign importers, has led the Forest Service to investigate the mechanical properties of this timber at the mill. A testing machine is installed at the mill of the E. P. Burton Lumber Company, at Charleston, S. C., and, under the supervision of the forester of the company, trees are selected in the forest and transported to the mill before sawing so as to yield test pieces which will furnish the required data with the least expenditure of effort and with the least consumption of material. In addition to collecting accurate data of the properties of this timber, the work will be directed to ascertaining the best kind of growth, and the conditions under which the best growth can be obtained. As the holdings of the Burton Company are under conservative forest management, it is evident that the testing

work at the mill will serve the general interests of the forestry movement.

Applications for Use of Forest Reserves

A very clear idea of what various uses are made of the national forest reserves may be had from the following applications received by the Forest Service:

M. E. Field, of Stehekin, Washington, has been granted permission by the Forest Service to conduct a hotel at the mouth of Bridge Creek in the Washington Forest Reserve.

The application of Charles P. Malory, of Grand Junction, Colorado, for permission to build a log cabin to be used as a summer residence, in the Battlement Mesa Reserve, Colorado, has been approved.

G. M. Parrish, M. D., of Chelan, Washington, has been granted permission to conduct a sanitarium at the mouth of Prince Creek, north shore of Lake Chelan, in the Washington Forest Reserve.

An application of the Kern River Company, Los Angeles, California, has been approved for a ditch and pumping plant right of way in the Sierra Forest Reserve (Southern Division), California.

The application of A. J. Samstag, of Farmersville, California, for permission to build a cabin in the Sierra Forest Reserve, has been approved.

The Forest Service has approved the application of L. B. Sperry, of Oberlin, Ohio, for permission to construct a trail from Glacier Camp to Mary Baker Lake, in the Lewis and Clark Forest Reserve, Montana.

The application of W. M. Finley, of Elk City, Idaho, for permission to conduct a public stopping place at the confluence of Red River and Moose Creek, in the Bitter Root Forest Reserve, Idaho, has been granted.

The application of the New World Smelting Company, of Seattle, Washington, for permission to build a wagon road in the Absaroka Division of the Yellowstone Forest Reserve, in Montana, has been approved.

The application of Edmund Kelly, of Pagoda, Colorado, for permission to construct an irrigating ditch in the White River Forest Reserve, has been granted.

The Forest Service has approved the application of A. O. MacLeod, of Mazama, Washington, for permission to conduct a public stopping place at Mazama, in the Washington Forest Reserve.

The application of Walter F. Horner, of Brinson, Washington, for the construction of 50 miles of trail along the Docowallip River in the Olympic Forest Reserve, Washington, has been approved.

The Forest Service has approved the application of J. H. Fuller for a corral in the Black Mesa Forest Reserve, Arizona.

The application of Will J. Margorum, of Stehekin, Washington, for the privilege of constructing an irrigating ditch within the Washington Forest Reserve, has been approved.

The Forest Service has approved the application of Frisbie D. Hutchinson for the construction of an irrigation ditch and reservoir in the White River Forest Reserve, Colorado.

The Board of Directors of School District No. 1, Wasco county, Oregon, has been granted permission to erect a school house within the Cascade Range Forest Reserve.

The application of the Mackinaw Mining & Milling Company, of Everett, Washington, for permission to construct a horse tramroad in the Washington Forest Reserve has been approved.

The Forest Service has approved the application of W. D. Wilson, of Newbill, California, for permission to conduct an apiary within the Santa Barbara Forest Reserve.

The application of the Commissioners of Modoc county, California, for permission to improve the public road within the Warner Mountains Forest Reserve has been approved by the Forest Service.

PRACTICAL FORESTRY IN NEW YORK

BY

E. S. BRUCE

Lumberman, U. S. Forest Service

A REFORMED scalawag often makes a peaceful and law abiding citizen. Then why should not a converted lumberman make a good forester? Not many years ago, I was an active member of that great army, who for nearly 300 years, have been chopping away at our forests with an eye only to immediate profit, and perhaps I am none the worse forester for having been a lumberman.

If we consider details, there are a vast number of ways of handling a forest. If we consider policy, there are only three. One of these is to harvest its product with a view only to present returns. That is the ordinary way, the lumberman's way. It is a policy whose inevitable consequence in the long run, would be the destruction of the forest, and the extinction of the lumber industry.

Another policy in forest utilization is to preserve it by wise use. That is the practical forester's way, and I am glad to say, it is very rapidly growing to be the lumberman's way also. The result of practical forestry, in a word, is the continuous production of a supply of timber which yields good financial returns without depreciating the capital stock—the forest.

Still another policy is to lock the forest up, so to speak—to protect it from fire and other dangers, which is excellent, but to protect it also from any form of utilization, which is foolish. This is neither the lumberman's way nor the forester's way, but the most extravagant policy of all, in its results, although its intention may be entirely praiseworthy. And that is the policy under which our New York State forest is administered. Until the constitutional amendment forbidding the cutting of any state timber

is repealed, we will continue to throw away each year enough money to pay all the expenses of caring for the preserve and to leave above and beyond that a considerable and increasing balance. I fully realize that the constitutional amendment may have saved the Adirondack Preserve from gross misuse in the past, but I am loath to believe that the State of New York is not now in a position to lumber its own forest conservatively, without danger. The preserve is now, as a great health and pleasure resort, yielding returns of incalculable value to the well-being of the state, and consequently of the nation, but before it can fill its full measure of usefulness, it must be made to produce, by skillful and conservative methods, a constant and increasing supply of wood. To lumber the preserve conservatively would not in the slightest degree impair its value as a health and pleasure resort or as a game refuge. Moreover, it would, through utilizing timber which under the present policy will continue to rot upon the ground, furnish permanently the staple upon which the development of local industries, the employment of labor, and in no small measure the continued prosperity of the northern portion of the state, largely depends.

When the conservative man of business has money lying idle, he puts that money to work in a stable enterprise which yields a reasonable profit. He does not bury it in the ground or hide it in the garret. The State of New York is not only failing to put its money out at interest; it is throwing the money itself away. It would be poor business policy for a farmer to raise a crop of wheat and to let it moulder on the stalk rather than to

harvest it. In exactly the same way it is poor business policy for the state of New York to expend large sums annually for the protection of its forests and to let the trees reach maturity, fall, and decay for lack of use. The failure to utilize the product of the Adirondack Preserve is in no sense laying up a store of timber for future generations, for it is a well established fact that production in an untouched forest is practically at a standstill. What is gained by the growth of the thrifty trees is offset by the decay of others, and the total amount of standing timber remains practically the same.

I take the point of view that it is the duty and province of the state, just as it is the duty and province of the individual, to make the most that it legitimately can out of what it has. I am unable to see why timber whose actual growth represents a return of many thousand dollars a year should be wasted, and it should be urged upon every business man, as men of affairs, to give force and direction to the movement to repeal the constitutional amendment which prohibits the conservative removal of any timber for any reason from the state forest.

The state may well follow the example of the Federal government which, upon its sixty-odd million acres of forest reserves is now under the direction of the Forest Service, putting into effect the sale of mature timber, to be removed under conservative regulations.

The average New York citizen has had neither the time nor the opportunity to look up the matter of state forests sufficiently to satisfy himself as to the best policy to pursue. He is chiefly desirous that the state forests be protected and maintained as a perpetual health and pleasure resort, and as a protection for the headwaters of the rivers. He would be pleased to have some system of forest management put in operation which would produce a revenue and make the forests of the state, in a measure, self-

supporting, continue the lumber industry, and furnish employment to a large number of citizens of the state, *provided always* that the system inaugurated should not impair the chief use and beauty of the forests.

To bring about these desirable results, the officials in charge of the state forests must be invested with power and authority to decide what method of treatment will best serve the requirements of each particular tract. They should possess a sufficient knowledge of practical forestry to *know* that the results will justify the course decided upon. They should have the authority, executive ability, financial backing, and the requisite business qualifications to carry out carefully and thoroughly the plans formulated to be pursued upon the different tracts regardless of the criticisms of theorists who disagree with them, and have the stamina to continue such treatment as a careful study of each tract should cause to appear advisable.

Wise management of the state forests must include as a requisite business qualification, and a very necessary one, the ability to determine accurately the value of the timber stumpage on the different tracts according to their locality, and no timber should be disposed of on any state land until a just minimum price has been fixed upon the stumpage to be sold. All timber sales should be thoroughly advertised prior to the sale, in the leading newspapers, then sold to the highest responsible bidder—sealed bids in every case with the right reserved to reject any or all bids, which should be done in every case if no bids exceed the minimum value placed on the stumpage; a bond to be required to insure payment for the stumpage, and the faithful carrying out of the rules and regulations prescribed to govern the cutting and removal of the timber sold.

Judicious management of the state forests would in many instances require the application of several different methods of treatment on one town-

ship, since a policy which would be advisable on one particular portion would not be advisable in another portion of the same township. A wise decision of the method of management and treatment that should be used for the different localities can only be made by men who are not wedded to some favorite theory, but are willing to adopt the method which is most desirable for the particular locality upon which they are engaged, who can lose sight of self and theory entirely, and after carefully looking over a tract, decide impartially and wisely what will be the best course to pursue with that particular tract, using any or all of the methods best calculated to bring about the desired result on that especial tract, or, if there have been none formulated that will serve the purpose, they should have a sufficient knowledge of the effect of treatment and consequent results to be able to decide with a certainty that the result will justify their decision, what course would be most advisable to pursue in the treatment of the tract in question.

There is to-day upon state land in the Adirondacks, a large amount of timber which should be removed and marketed, for the very apparent reason that the more mature trees are constantly dying and going to decay, and the state is unwisely losing money by allowing them to thus become unsalable. It would be a better policy to utilize such timber when it is possible to do so without serious injury to the forest. The moneys derived from the sale of timber could be placed in a separate fund and used only for the purpose of purchasing forest land to consolidate the park, for replanting waste or burned areas, or other desirable work for the improvement of the state forests. The sale of the timber when advisable and the use of the revenue derived from the sale to purchase forest boundary lines of the Adirondack Park, would be a long stride toward consolidating the state forest.

Any system of public forest management should have as its foundation

the perpetual maintenance of the forest to conserve and regulate the streamflow. The conservative removal of the mature timber should be considered as of secondary importance, and be done only in such manner that no serious damage be caused to the remaining forest, nor should the natural beauty of the forest be marred more than absolutely necessary, nor its capability of natural reproduction injured. In no place in the Adirondacks should so much timber of any species be cut as to make it necessary to replant, since this method will so open up the forest and break the sheltering foliage by removing the large-topped trees as to allow the unobstructed rays of the hot summer sun and the summer wind to dry up the moisture of the unprotected earth in a far greater degree than in those portions of the forest where but few trees are selected, and the protecting cover remains practically unbroken.

The marked difference in the earth's moisture between the too extensively thinned forest, and that portion from which but few trees per acre have been selected, is, in comparison, like the difference between a "fallow" cut for the purpose of clearing up the land, and the wise farmer's treatment of his maple sugar orchard, from which he removes only the old and defective trees for his fuel supply, or to make room for the growth of younger and thrifter trees in their stead. The general principles involved are the same, only in a lesser degree.

Forest fires are unquestionably the worst enemy of the forests throughout the United States, and they have done more to impair the beauty of the Adirondacks as a health and pleasure resort, and to lessen their efficiency as a regulator of the water flow, than all the other causes combined to which the destruction of the forests are usually attributed.

No system of forest management can ever bring them to the highest degree of usefulness and beauty com-

bined, which does not include therewith a thorough patrolling during the dry season by alert and energetic rangers, of all the main traveled trails, roads, railroads, and places where fires are most likely to be started. One forest fire, under certain conditions, would quickly and thoroughly destroy all the advantages gained by several seasons' hard work. In the matter of forest fires, the old adage might well be changed to read: "An ounce of prevention is worth many pounds of cure." Thorough patrolling and preventing the starting of forest fires in dry seasons is the best and the only sure way of fighting them.

I want to say right here that I am as bitterly opposed to allowing any of the old system of "cut and slash" lumbering to be put in operation in the public forests of the State of New York as anyone can possibly be. I am deeply interested in the welfare of the Adirondacks, where the greater part of my life has been spent in some capacity closely connected with the forests of this state, of which I am still a legal resident, and have an earnest desire to see the public forests of the Empire State administered on sound business principles, always carefully safeguarding the combined interests of the people.

PRACTICAL RESULTS OF THE CUP AND GUTTER SYSTEM OF TURPENTINING

BY

CHARLES H. HERTY, Ph. D.

THE cup and gutter system of collecting crude turpentine, proposed as a substitute for the box system commonly in use, was described at length in Bulletin 40, Bureau of Forestry. The saving that it effected was also shown in the experimental tests, the results of which were given at the same time.

Since the publication of the bulletin, experimental and comparative tests have been carried on steadily, but only the results of a year's commercial test of the new system on the turpentine farm of Messrs. Powell, Bullard & Co., at Ocilla, Ga., have been published.

The matter contained in this article is issued to show the practical results of three years' working of the new system, to call attention to several improvements that have been made in equipment and methods, and to point out several faults that have

developed. All the comparative tests were made on similar half crops as described in Bulletin 40. Readers who are not familiar with turpentinizing are referred to that publication, but it may be said in general that in this system the resin is collected in a suitable vessel, preferably of hard burned clay, being caught and conducted to this vessel by inclined metal gutters inserted in shallow cuts in the tree.

The advantages claimed for the system were two: First, that it protects the tree against the destructive action of storms and fire; second, that it increases both the quality and the quantity of the product.

RESULTS.

Since the publication of Bulletin 40 the plot of timber there described as a "first-year crop" has been worked two years more, as a "second-year crop" and as a "third-year crop," com-

plete records being kept of the yield from the "boxed" and "cupped" halves of the crop, together with careful studies of the condition of the trees in each.

Messrs. Powell, Bullard & Co. have courteously furnished the results of

the second and third years of operation. Summaries of these figures are given in Tables I, II, and III. They show that the cupped trees yielded \$1,284.04 per crop, or over 30 per cent, more than the boxed trees.

TABLE I.—*Spirits of turpentine from half crops.*

Year	Cups			Boxes			Excess from cupped half crop	Net price per gallon at time of operation	Value of cup excess
	From dip	From scrape	Total	From dip	From scrape	Total			
	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Gallons.</i>	<i>Cents.</i>	
First.....	1,385.3	205.0	1,590.3	1,134.7	153.7	1,288.4	301.9	40	\$120.76
Second.....	1,103.5	165.0	1,268.5	705.2	226.6	931.8	336.7	45	151.52
Third.....	781.3	136.0	917.3	536.1	190.5	726.6	190.7	45	85.82
Total.....	3,270.1	506.0	3,776.1	2,376.0	570.8	2,946.8	829.3		358.10

TABLE II.—*Net sales of rosin from half crops.*

Year	Cups			Boxes			Excess from cupped half crop
	From dip	From scrape	Total	From dip	From scrape	Total	
First.....	\$401.72	\$47.72	\$449.44	\$328.40	\$35.53	\$363.93	\$85.51
Second.....	286.88	58.24	345.12	132.42	84.08	216.50	128.62
Third.....	212.60	61.65	274.25	124.76	79.70	204.46	69.79
Total.....	901.20	167.61	1,068.81	585.58	199.31	784.89	283.92

TABLE III.—*Summary of gain from cupped half crops.*

Year	Spirits of turpentine	Rosin	Total
First.....	\$120.76	\$85.51	\$206.27
Second.....	151.52	128.62	280.14
Third.....	85.82	69.79	155.61
Total.....	358.10	283.92	642.02

Total value of products from three years of operation.

Cupped half crop..... \$2,688.55

Boxed half crop..... 2,046.53

Gain from cupped half crop..... 642.02=\$1,284.04 per crop.

CONDITION OF TREES.

At regular intervals during the three years of operation, careful study was made of the condition of the trees in each half of the crop. The results of these studies by years follow:

TABLE IV.—*Record of down and of dead trees.*

	Number of trees blown down		Number of trees dead.	
	Boxed	Cupped	Boxed	Cupped
In 1 year	8	3	35	16
In 2 years	60	34	139	83
In 3 years	78	44	217	150

Of the 44 trees blown down in the cupped half of the crop during the three years of operation, only 8 fell because they were being turpented. These 8 were small trees on which too deep incisions had been cut by the broadax. Of the 78 trees blown down in the boxed half of the crop, the fall of 59 was due to the cutting of the boxes. The larger number of cupped trees blown down from causes other than the method of collecting the resin is due to the fact that many had doty hearts and were unfit for boxing, but just as well suited to cupping as sound trees. Many of these were snapped off above the turpentine face by a storm in the spring of 1903.

TABLE V.—*Productive surface lost from all causes.*

	Boxed trees	Cupped trees
	Per cent.	Per cent.
In 1 year	21.02	10.60
In 2 years	30.78	21.20
In 3 years	34.20	27.12

By far the greater part of this loss in both half crops was due to constantly increasing "dry face." It is evident that in the first year the box cutting was largely responsible for the wide disparity in the amount of dry

face in the two half crops, but after the first year the chipping was the determining factor. In fact, the rate of increase of dry face after the first year is greater in the cupped than in the boxed trees, and is due, no doubt, to the higher average number of faces per tree in the cupped half. (See Bulletin 40, page 27.)

IMPROVEMENTS.

Since the cup and gutter system has been in use, a number of improvements in the equipment and in methods have been made.

Cups.—The quality of the cups has been materially improved. Many of those first used allowed the resin to seep through. This was due to the fact that the cups were made in molds, a method of manufacture requiring a soft, wet clay. This objection has been entirely overcome by the use of machinery and a stiff and much drier clay. The new cups allow no seepage and are just as desirable for collecting the resin as if they had been glazed at considerable cost.

Shipping the cups.—The complete success attained in shipping the cups in bulk has effected a saving to the operator, both in decreased breakage in transit and in the cost of the wooden crates formerly used.

Dipping.—At the time cups were introduced it was hoped that with experience the dippers would be able to collect as much gum per day from cups as is usual from boxes. This hope has been more than realized, for in practically all cases it has been found that the dippers are able to collect more gum per day from cups than from boxes. Difficulty was frequently experienced in getting good box dippers to undertake the dipping of cups, but after the change was once made a preference for cup dipping was uniformly noticed.

Use of the broadax for facing.—The most important advance made in the application of the cup and gutter system has been the substitution of the broadax for the club ax in making

the flat faces on the trees. The difficulty in using the cornering ax recommended in Bulletin 40, on the hard timber near the Gulf coast in south Florida, led to the suggestion by Mr. R. M. Radford, of Braidentown, Fla., that the broadax be used for making the faces. The experiment was tried, and the result was faster and better work and a good surface for beginning chipping. Later, Mr. H. H. Ellarbee, of Ellarbee, Fla., suggested that the usual setting of the broadax on the handle be reversed, so that in hewing the beveled side would be next

possible to double the speed of a squad, and many laborers have become very skillful in this use of the broadax. One laborer during the past winter prepared in one day 1,700 faces. Inspection of the work shows that it was well done in every respect.

Directions for using the broadax.—The ax should weigh from 8 to 9 pounds and have a perfectly straight edge. The handle should be straight and not longer than 30 inches. Each laborer sets his ax on the handle so that its edge is parallel to the handle and the beveled side lies next to the tree in hewing.

By almost vertical strokes of the ax a flat surface is hewn one-half the width of the "face" which is to be chipped later (fig. 1). When the ax first catches the wood the chip is prized outward slightly, thus facilitating the easy entrance of the ax in the same cut on the second stroke and also keeping the surface smooth. On the third stroke it usually is possible to partly cut and partly break off the chip, thus avoiding useless mutilation of the tree. This is done by a twist of the ax, given just as it falls into the previous cut, the eye of the ax being thrown against the tree and the edge outward. The laborer then steps either forward or backward and hews the second side of the angular face (fig. 2), taking care to leave no rounded surface in the center where the two sides join.

On these flat surfaces the incisions for the gutters are then made, one a right-handed and the other a left-handed cut (fig. 3). In making these cuts the ax is held so that the outer point of the edge is lower than the inner point, while the eye of the ax is lower than the edge. By a single blow a cut is made the full width of one side of the face, this cut being about one-quarter of an inch deep at the outer edge of the face and a little deeper at the center. The cuts should be at least one inch apart at the center of the face, to prevent choking between the two gutters by chips and "scrape," and for convenience in clean-

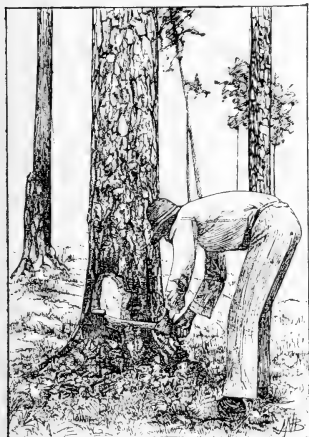


Fig. 1.—Making the first half of a face

to the tree. This change greatly increased the speed of the work, as the chip could be promptly slit off after the full width of the face had been obtained.

The next step was to have one man make both incisions for the gutters instead of employing a right-handed and a left-handed axman for making the two. At the outset the laborers usually insist that one man cannot make both cuts, but a little practice gives perfect facility in cutting each with equal ease.

These changes have made it easily

ing the gutters when the cups are dipped.

Zinc nails.—The cup and gutter system has been most favorably received by the owners of mills where the timber is sawed after it has been turpen-



Fig. 2. Making the second half of a face

ted. The only objection they make is to the use of iron nails for hanging the cups. To meet this objection zinc nails are now manufactured for use with the cups. Experiments have shown that if such a nail is left in the tree no damage whatever is done to a saw that strikes it, because the metal is so soft.

ERRORS MADE IN USING THE CUP AND GUTTER SYSTEM.

Gutters.—In making the incisions for the gutters the eye of the broadax is frequently turned down too much. The outer half of a gutter inserted in angle to the trunk of the tree, and hence forms a shelf rather than a trough (fig. 5, B). From such a gutter the resin frequently runs off along the outer edge. Furthermore, such a gutter is easily forced out when the dipper is removing the "scrape" from such an incision lies almost at a right it, the pressure of the dip knife being

almost in line with the direction of the cut. A gutter inserted carefully into a properly made incision will never fall out (fig. 5, A.)

Nails.—Two mistakes are frequently made in driving the nail on which the cup hangs. First, the nail is driven horizontally. In the latter part of the season, when hardened resin collects under the head of the nails, a cup hung on it will easily drop off. The head of the nail should have a steep slant upward. A cup hung on a nail so driven fits snugly between the nail and the tree, is secure, and cannot swing away from the spout of the lower gutter, though it may be easily removed by the dipper. Second, the nail is often driven into the tree above the lower end of the lower gutter. A cup hung on such a nail is never vertical, and its capacity is therefore diminished. Further, when a cup so hung fills with water or resin the increased weight tends to bring it to a vertical position, thereby pressing on the lower gutter and causing the latter to be prized out of the incision. The nail should always be driven into the tree at a point slightly lower than



Fig. 3.—Making incisions for the gutters

the lower end of the lower gutter (fig. 4.)

Cups.—Experience has demonstrated that the cups will be broken if wa-

ter is frozen in them. During the winter, therefore, when the cups are not in use, they should be removed from the nails and inverted at the base of the trees, so that water can not collect in them.

FIXING LOOSE GUTTERS.

In case a gutter is displaced during the chipping season, the accident can be easily repaired by reinserting it in

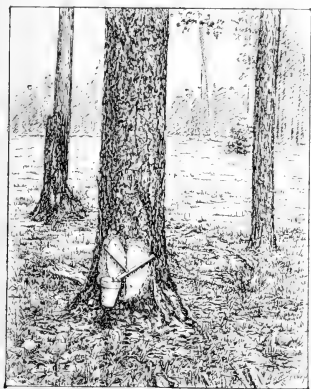


Fig. 4.—Cup and gutters properly placed

the old incision and driving two nails into the tree flush with the bottom of the gutter—one nail near the center of the face and the other near the upper end of the gutter. Supported by these two nails a gutter will stand the scraping of the dip knife without slipping. The gutter and both nails can readily be drawn from the tree at the end of the season.

The rapid introduction of the cup and gutter system by turpentine operators proves beyond a doubt that the experimental stage has been passed. No stronger confirmation of the value of the results obtained at Ocilla, Ga., could be given than the fact that by far the greater portion of the cups placed during the past winter were on farms where the cup had been tested on a small scale during the preceding season. Not all operators are yet con-

vinced; there are still doubters and scoffers, but their number is rapidly diminishing.

In the hands of a few the system has been abused. The fact that under it the trees are not weakened and made subject to overthrow by windstorms, as boxed trees are, has induced some operators to largely increase the number of cups per tree as compared with the average of boxes. The returns from such trees prove that there is a distinct limit to the sap surface which can be removed without weakening the vitality of the tree and lessening the flow of resin. The practice of overcupping results, therefore, in a financial loss.

In addition to the increased returns from the use of cups, the naval stores industry has been benefited in two other lines by the development of the cup system. In many cases timber owners have made decided concessions in their leases to operators, on condition that the cups be used and no boxes cut. In other instances large tracts of timber have been brought under turpentine operation by the cup system, though their owners have persistently refused to lease them for box cutting.

The rapid rise in the value of turpentine timber within the past few

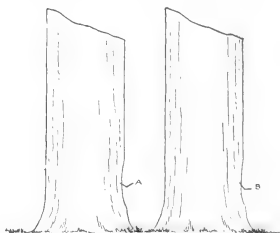


Fig. 5.—Position of gutters on the face
A, correct; B, incorrect

years has contributed largely to its more conservative treatment. A thing of little value in the past, it has received only a small amount of care. Its rapid enhancement in value, and the strong probability of a still further

increase, gives the turpentine operator every reason to treat his timber carefully. Formerly it was an easy matter for an operator to work hastily through a place, then move a short distance and develop a new place on timber just as inexpensive as that on which he had been working. But now the operator knows that when his present location is exhausted he is certain

to experience difficulty in finding a new location, and equally certain that a largely increased price must be paid for it. This natural operation of the law of supply and demand is rapidly bringing serious and earnest thought to the question of how best to preserve the present holdings. The cup and gutter system with its great economies is doing much to solve the problem.

RECENT PUBLICATIONS

Manual of the Trees of North America.

By Charles Sprague Sargent, Pp. 826. Illustrated with plates by Charles Edward Faxon. Price, \$6.00 net. Houghton, Mifflin & Co., Boston.

Professor Charles Sprague Sargent has done a valuable service not alone for scientists, but for all those who are interested in outdoor life, by the publication of his "Manual of Trees." Up to the present time the author has appealed only to those who have made a special study of trees and shrubs; his monumental work, "The Silva of North America," being the greatest work on the subject ever published. But in this manual, he has set forth the general facts pertaining to the study of trees, their descriptions and uses, in a way which will appeal to the general public.

Persons traveling in Florida, California, or Canada will find it an interesting book to take along with them as a guide to the trees. Persons having country estates will find a genuine need for the volume, which will immediately be given a place similar to that held by Gray's Botany.

The Manual contains brief descriptions in plain and simple language of about 630 trees, accompanied by a figure of the leaves, fruits and flowers of each tree, with keys leading to a ready determination of the genera and species. It makes available in convenient form the most essential points of the information to be found in the "Silva of North America," and will be indispensable to every one interested in nature, to all teachers, to the owners of country places, landscape-gardeners, park superintendents, foresters, and lumbermen.

Type Studies from U. S. Geography.

By Charles A. McMurray, Ph. D. Pp. 288. Illustrated. Price, 50 cents. Macmillan & Co., New York.

This volume contains twenty-five type studies in United States geography arranged in an interesting and instructive manner. Among the subjects treated are chapters on forests, lumbering and irriga-

tion. It is a volume that should help many to a better understanding of this country's resources.

The Tree Doctor.

By John Davy. Pp. 87. Illustrated with half-tones from photos. Saalfeld Publishing Co., Akron, Ohio. Price, \$1.00.

This book is what the title indicates, a treatise on tree surgery, which gives many points worth knowing on the care of trees. It is handsomely and appropriately illustrated with nearly two hundred half-tones. There is also a fatherly lot of moralizing in different parts of the volume, and altogether it is a useful, though peculiar, book. Such a well printed volume deserves a better binding.

Official Proceedings of the Twelfth National Irrigation Congress, El Paso, Texas, November 16-18, 1904. Pp. 442. Illustrated. Published by Guy E. Mitchell. Galveston, Texas: Clarke & Courts, 1905.

This is the complete official proceedings of the Twelfth National Irrigation Congress—the most successful and widely attended convention in its existence. There is a vast amount of matter contained in the volume of practical value to all, but it should especially appeal to the westerner, the forester, the irrigator, the farmer, the stockman, and citizen of the arid and semi-arid half of our country.

Third Annual Report of the Reclamation Service, 1903-1904. F. H. Newell, Chief Engineer. House Document No. 28. Pp. 644. Washington, D. C., Government Printing Office, 1905.

In the first annual report of the Reclamation Service, issued November 29, 1902, a brief description of the location of the arid lands of this country and a summary of the history of the national irrigation movement, irrigation laws, and conditions in the various states were given. The second report included a general discussion of the reclamation law, decisions relating to the

same made by the Secretary of the Interior, and gave particular details of the work accomplished in each state. In this, the Third Annual Report, is given a continuation of the description of the work begun; in particular an exhibit is made of the operations carried on during the greater part of the calendar year 1904. This matter is preceded by a general discussion of the reclamation law and of the general questions of policy or practice which have arisen. It should prove an exceedingly helpful volume to the homeseeker, irrigator, farmer, or general student of the West. Each particular section of the country in which work has been begun, or is under consideration is described and the experts of the service write of its feasibility, methods of utilization of the water realized, etc.

The Nile in 1904. By Sir William Willcocks, K. C. M. G., F. R. G. S. Pp. 225. Illustrated with maps and diagrams. E. & F. N. Spon, Limited, London. American agents, Spon and Chamberlain, 123 Liberty street, New York. National Printing Department, Cairo, Egypt, 1904. Price, 9 shillings.

There has probably never been so gigantic an engineering enterprise so successfully accomplished as the harnessing of the Nile by the Public Works Department of Egypt. Sir William Willcocks has played no small part in the subjugation of this majestic river, his twenty years of experience in irrigation gained through work in India and Egypt have equipped him, as well as any of those concerned in the stupendous works along the Nile, to write of what has been accomplished. Sir William modestly acknowledges in a preface his indebtedness to several previous reports by such of his co-workers as Sir William Garston, and others. The volume itself is an authoritative description of the Nile and the Nile country, with descriptions, diagrams, statistical matter, and maps innumerable, and the semi-narrative style, with history of the operations make it very interesting. The statistical matter, minute descriptions of localities (supplemented by maps) and discussions of irrigation in all its phases in Egypt make it an exceedingly valuable volume.

Proceedings of the Third Irrigation Congress, held at Bismarck, N. D., January 25, 26, 1905. Published by authority of the State, Bismarck, N. D., 1905.

This report is replete with valuable addresses and information, and it should be in the hands of every one interested in the material welfare of the state, and especially of those interested in the reclamation of land either by irrigation or drainage. It contains papers upon "General Farming in North Dakota," "Pumping Water for Irrigation," "The Development of Irrigated Agriculture in North Dakota," "Intensive

Farming by Aid of Irrigation," "Fruit Growing," "Cooperative Canal Construction," "Irrigation and Drainage Investigations," "Alfalfa and Its Possibilities," "The Artesian Basin in North Dakota," and a number of others, all by the highest and most competent authorities. It contains also the North Dakota Irrigation Code, the United States Reclamation Act, a proposed form for Articles of Incorporation for Water Users' Associations and other important information. It is seldom that so much of value concerning the subjects treated has been brought into such practicable form and so small compass. Copies may be obtained by application to the State Engineer, A. L. Fellows, at Bismarck.

The A, B, C of Bee Culture. By A. I. Root, revised by E. R. Root. Pp. 490. Copiously illustrated. The A. I. Root Company, Medina, Ohio, 1905.

Here is an immense lot of practical information about bees and bee culture arranged in the form of a cyclopedia for bee-keepers generally. The publishers are one of the largest manufacturing plants solely concerned with honey in the country, and the matter contained in this book has been gathered by them from bee-keepers all over the country, and verified by practical work in their own factory. The book was originally written in 1878; this is the fourth edition issued since that time, and has been brought up to date and re-edited by Mr. Ernest R. Root. The matter contained is extremely diversified and eminently practical in its nature, and so presented as to be easily accessible for reference. There is a lack of entire continuity through the book through numerous changes ranging from the editorial "we," the personal "I" to the impersonal "one," which are slightly confusing.

Yearbook of U. S. Department of Agriculture for 1904. Pp. 776, illustrated. Washington, Government Printing Office, 1905.

The 1904 Yearbook of the Department of Agriculture contains many articles which should prove of particular interest to the forester and irrigator, as well as the farmer, for whom it is especially designed. Besides the formal report of the Secretary for the fiscal year of 1904, the volume is given over to articles dealing with special phases of the Department's work in all its varied fields of activity. "The Attitude of Lumbermen Toward Forest Fires," by E. A. Sterling; "Forest Planting and Farm Management," by Geo. L. Clothier; "Potato Culture Near Greeley, Colorado," by J. Max Clark; "Insect Injuries to Forest Products," by Dr. A. D. Hopkins, and "The Determination of Timber Values," by Edward A. Braniff, are all valuable additions to the existing literature on forestry and irrigation.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., June 9, 1905. Sealed proposals will be received at the office of the Supervising Engineer, United States Reclamation Service, 1108 Braly Building, Los Angeles, California, until 2 o'clock p. m., August 17, 1905, and thereafter opened, for the construction of about 12 miles of dike, involving excavation of about 445,000 cubic yards of earth, and clearing 125 acres, for the reclamation of Yuma Valley, Arizona. Specifications, forms of proposals and plans may be obtained from the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., from the Supervising Engineer, Los Angeles, California, and from the Engineer of the Reclamation Service, Yuma, Arizona. Each bid must be accompanied by a certified check for three (3) per cent. of the amount of the bid, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract, and furnish bond in the sum of 20 per cent. of the contract price for the faithful performance of the work. It must also be accompanied by the guaranty of responsible sureties to furnish bond as required, if the bid be accepted. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the Service may require. Bidders are invited to be present. Proposals must be marked: "Proposals for the construction of dikes, Yuma project." E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., July 3, 1905. Sealed proposals will be received at the office of the Engineer, U. S. Reclamation Service, Montrose, Colorado, until 10 o'clock a. m., August 28, 1905, for the construction of about 8 miles of main distributing canal, involving the excavation of 52,000 cubic yards of material and the placing of 20,000 cubic yards of concrete masonry for the conveyance and partial distribution of 1,300 cubic feet of water per second from the mouth of the Gunnison Tunnel, near Cedar Creek, to a point on the Uncompahgre River 9 miles south of Montrose, Colo. Full information may be obtained from the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., from the Supervising Engineer of the Reclamation Service, Chamber of Commerce Building, Denver, Colo., or from the Engineer of the Reclamation Service, Montrose, Colo. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., July 12, 1905. Sealed proposals will be received at the office of the Supervising Engineer, United States Reclamation Service, Chamber of Commerce Building, Denver, Colo., until 2 o'clock p. m., August 16, 1905, and thereafter opened, for the construction of the Pathfinder Dam and auxiliary works, at a point about 50 miles southwest of Casper, Wyo., to impound the flow of North Platte River. Plans, specifications, and forms of proposal may be obtained by application to the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., or to the Supervising Engineer of the Reclamation Service, at Casper, Wyoming. Each bid must be accompanied by a certified check for \$10,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of \$50,000 for the faithful performance of the work. Each bid must also be accompanied by the guaranty of responsible sureties to furnish bond as required, if bid be accepted. The right is reserved to reject any or all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the Service may require. Bidders are invited to be present when bids are opened. Proposals must be marked: "Proposals for Pathfinder Dam, Wyoming." F. L. CAMPBELL, Acting Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, July 7, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Billings, Mont., until 2 o'clock p. m., September 5, 1905, for the construction of the Shoshone dam, spillway, outlet and road tunnels, requiring about 69,000 cubic yards of concrete masonry and about 75,000 cubic yards of excavation, located eight miles west of Cody, Wyoming. Plans, specifications and proposal blanks may be obtained from the Chief Engineer of the Reclamation Service, Washington, D. C., or from Jeremiah Ahern, Engineer, Cody, Wyoming. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, July 7, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Billings, Mont., until 2 o'clock p. m., September 6, 1905, for the construction of a tunnel approximately 18,000 feet long, and auxiliary works, including about 28,000 cubic yards of excavation in open cut, all located ten miles east of Cody, Wyoming. Plans, specifications and proposal blanks may be obtained from the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., or from Jeremiah Ahern, Engineer, Cody, Wyoming. E. A. HITCHCOCK, Secretary.

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1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.
2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.
3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.
4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.
5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.
6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

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Forestry and Irrigation

H. M. SUTER, Editor

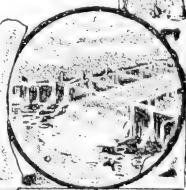
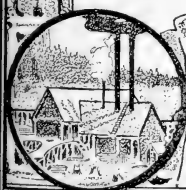
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REDWOOD LOGGING

"Fallers" making the undercut, Caspar, Mendocino County, California. After this has been done and the bark cut away, a saw is used.

Forestry and Irrigation.

VOL. XI.

AUGUST, 1905.

No. 8

NEWS AND NOTES

Special California Number

The greater part of this issue of FORESTRY AND IRRIGATION is given up to a discussion of the forest and water problems of California. No state in the country offers a more inviting field to the student of economic questions as affected by forests and waters; to the forest and irrigation engineers it presents many striking problems, and on their skill in solving these problems much of the future prosperity of the state depends. In this number there is a series of notable articles by the experts in charge of the California work that deserve close reading. They outline very fully the work now going on, and that to be taken up later.

This California number, by the way, follows the plan begun last month of treating in particular of the forest and water problems of a single state, with a view to their better understanding. In July the forest situation in Connecticut was discussed; next month the proposed Appalachian Forest Reserve will receive special notice. The October issue will deal at length with Minnesota forests, and in November Maryland will be taken up.

Reclamation Work in Southwest

Mr. B. M. Hall, supervising engineer of the U. S. Reclamation Service in charge of operations in New Mexico, Texas and Oklahoma, reports that field work in the valley of the Rio Grande has been suspended on account of flood conditions, but the surveys have already been carried to such a point that plans and specifications are being prepared for the main canal in Mesilla Valley.

Water users are fully awake to the benefits which will accrue to them with

the completion of the government irrigation system, and are eager to co-operate by pledging their lands through the Water Users' Association formed for the purpose in both Texas and New Mexico.

Both the Rio Grande project and the Yuma project on the Colorado River in Arizona and California, involve complicated international questions, and it is probable that a draft for a treaty between the two countries will be submitted for the consideration of the Department of State in the near future.

Work on the Hondo project under the contract of the Taylor-Moore Construction Company, which has been taken over by the United States, is partially completed. Recommendations have been made that the contract for constructing the earthwork on embankments 3 and 4, consisting of about 200,000 cubic yards, be relet. It has been decided to finish the remainder of the work on force account. Plans have been completed for the canal system under this project, and final surveys are being made.

Rapid progress is being made in the investigation looking to the practicability of purchasing the irrigation system at Carlsbad.

Two field parties are at work on the Navajo project, Oklahoma. It is estimated that the Navajo reservoir on the North Fork of Red River, will conserve a water supply sufficient for the irrigation of nearly 75,000 acres.

Coke Company to Plant

The Forest Service has received an application for a planting plan from the H. C. Frick Coke Company, of Uniontown, Pa., which has several

thousand acres of land in Westmoreland, Fayette, and Greene counties, Pa. Part of this land is under cultivation, and the rest is idle owing to the coal having been taken out. None of it is very profitable, and the company is proposing to plant trees on it. Such rapid growing varieties as are suitable for fence and pit posts are desired. It is also proposed to plant such varieties as will yield good sized timbers in fifty or sixty years. Mr. S. N. Spring, Forest Assistant, has been detailed to make the preliminary examination for this company.

New Use for Virginia Pine

The Virginia pine, commonly known as scrub pine, is no longer regarded as worthless except for cordwood. Within the last four years the manufacturers of wood-pulp have tried the wood with success, and several mills, in Pennsylvania especially, are using it in considerable quantities for this purpose. One Pennsylvania mill consumes in this way 20,000 cords a year.

The scrub pine, whose range is chiefly in Tennessee, North Carolina, Kentucky, Maryland and Virginia, is found in large quantities in old fields in the last two states in particular, where it has reproduced itself, unheeded since the Civil War. It has recently been found in commercial quantities also in central Pennsylvania. Since it is a tree which thrives on even the poorest soil, and reproduces itself with great ease, its entrance into commercial importance will offer a very interesting problem in forest management, and one which promises quite unexpected results.

Planting to Preserve Water Supply

The Forest Service is preparing to plant a large area of denuded land in the new additions to the Gila River Forest Reserve near Ft. Bayard, N. Mex. The main purpose of the proposed planting is to preserve the water supply for the great military hospital at Ft. Bayard. A nursery nine-tenths of an acre in area has been

established and a party of four men is now making a detailed study of the proposed planting sites in the reserve, in order to prepare the planting plans.

Forest Inspectors

The present assignment of forest inspectors on the National Forest Reserves is as follows: E. S. Bruce, the Big Horn Forest Reserve, in Wyoming; Smith Riley, the Leadville Forest Reserve, in Colorado; Elers Koch, the Madison Forest Reserve, in Montana; J. H. Hatton, the Sevier Forest Reserve, in Utah; and R. E. Benedict, the Prescott Forest Reserve, in Arizona.

Planting for Shelter Belt

The buying of the neglected or abandoned farms in New England for summer homes by city people is leading to forest planting in certain of the old fields for protection, ornament, or economic purposes. The Forest Service has recently given assistance along this line by preparing a plan for a shelter belt on an estate owned by the Rev. Edward Everett Hale. The estate is in southern Rhode Island, near Wakefield, where the strong gales from Long Island Sound have full sweep over the country. A shelterbelt 40 feet wide composed of pitch pine, Norway spruce, and Scotch pine, will be planted on the windward side of the farm. The pitch pine, which is a species able to endure strong salt-laden winds, will be planted in the outer row, with the Norway spruce and Scotch pine back of it. These trees are so arranged that by their different rates of growth they will form a belt with a slanting top lowest to windward, so that the wind will be deflected above the fields which it is desired to protect.

Examining Mineral Claims

Mr. Alexander C. Shaw and Mr. G. W. Woodruff, of the Forest Service; Mr. Frank Bend, of the General Land Office; and Mr. A. E. Chandler, of the Reclamation Service, are visiting several of the forest reserves for the purpose of inspecting and reporting on mineral and other claims.

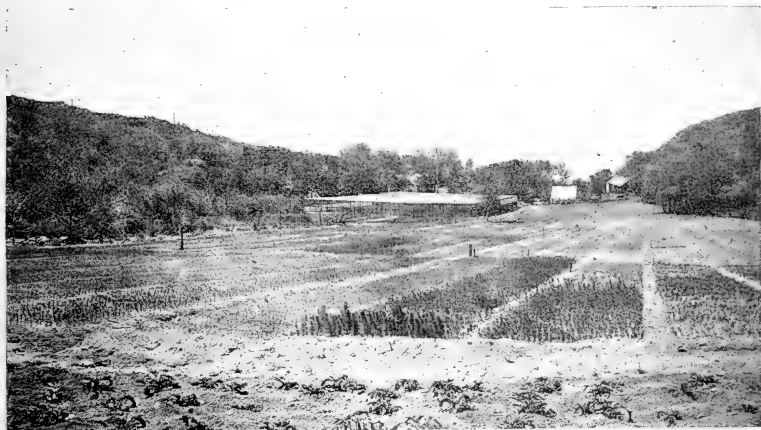
Forest Planting on Watershed

A representative of the Forest Service recently visited the nearly completed reservoir of the Metropolitan Water Board at Clinton, Mass., where extensive forest planting work is being carried on. This reservoir and dam is one of the largest in New England, and to insure sanitary conditions at the sources of the water supply the adjacent region through which the streams flow has been acquired and is under the management of the board. Part of this area is covered with natural timber; other portions are bar-

ren or brush covered. Upon the open lands forest planting is being done. The species thus far used are white pine, chestnut, maple, and hickory. On some of the brush covered areas white pine seedlings were planted 10 feet apart and hickory nuts planted between them. In other places sugar maple seedlings have been mixed with the white pine to act as a lowerstory to the more rapid growing evergreen tree. On one field a series of experimental plantations have been made in which

Trouble on Colorado River

A combination of peculiar topographic features and prolonged floods has wrought great havoc in southern California and southwestern Arizona, and



Henniger Flats Nursery, San Gabriel Forest Reserve

(See article in this number by T. P. Lukens)

ren or brush covered. Upon the open lands forest planting is being done.

The planting work has been going on for about four years and approximately 200 acres are planted annually. The species thus far used are white pine, chestnut, maple, and hickory. On some of the brush covered areas white pine seedlings were planted 10 feet apart and hickory nuts planted between them. In other places sugar maple seedlings have been mixed with the white pine to act as a lowerstory to the more rapid growing evergreen tree. On one field a series of experimental plantations have been made in which

still greater calamity threatens the settlers unless immediate steps are taken to keep the Colorado River between the banks of the original channel.

The silt borne down from the mountains through past centuries by the Colorado River has built up a great delta, cutting off an arm of the sea and gradually raising the river bed till the water flows on a ridge nearly 400 feet above the basin, which has long since been dried out by evaporation.

In 1904 the California Development Company cut a canal about four miles below the Mexican boundary, opening

a short cut from the river to their main canal. No headgates were provided, and during the high water period of the past winter the banks of the canal eroded and the ditch deepened until over 50 per cent. of the flow of the river was running through the canal into Salton Sink. Unsuccessful attempts were made to shut off the flow into the canal, and there is a grave possibility of the river abandoning its present channel to the Gulf of California and forming an inland sea in Salton Basin.

The flooding of this basin means the possible submergence of the Imperial Valley with the farms, homes, and other improvements of nearly 8,000 people in California, also of settlements on the Mexican side, and the destruction of 120 miles of the Southern Pacific Railroad, a transcontinental line.

Opposite the heading of the canal through which the water is now rushing lies a long island, and an attempt is being made to divert the river to the east channel around this island by a dike about 3,000 feet up stream from the canal heading. This diversion, if successful, may work serious injury to the Yuma irrigation project as now planned by the engineers of the U. S. Reclamation Service, but if the river is properly handled it is believed the damage will be slight compared with the greater evil of allowing it to flow into the Sink.

As the greater part of the danger and loss will occur in the United States, steps are being taken to perfect protective measures immediately.

Purchase Irrigation Works

The Secretary of the Interior has approved the option to purchase the property of the Klamath Falls Irrigating Company, known as the Ankeny Ditch, for the sum of \$50,000.

This ditch will be enlarged and improved by the government, and a large part of it ultimately will be used as the upper end of the main canal of the Klamath project.

The Secretary of the Interior has authorized the purchase of the Little Klamath Water Ditch Company's rights and property, known generally as the Adams Ditch, for use in connection with the Klamath Falls irrigation project. This ditch system is to be used as a part of the project and the agreement to sell includes also certain color of right to lands now under water, and which are to be drained and used for irrigation purposes.

The Secretary has also approved the purchase of certain rights and property of the Jesse D. Carr Land and Live Stock Company from Mr. S. L. Akins. This purchase involves a large area of land for the Clear Lake reservoir site also rights of way for ditches to be constructed by the United States over these lands and certain color to right of lands now under water which will be drained and irrigated.

The former purchase is to be made for the sum of \$100,000 less certain deductions stipulated in the agreement, and the latter for the sum of \$187,500.

Michigan Forestry Association

The organization meeting of the Michigan Forestry Association will be held at Grand Rapids, Mich., August 29 and 30. Preliminary organization of the association was effected some months ago, through the efforts of a number of those interested in forestry in the state, and the work of the association has been carried on by provisional officers. The coming meeting is arranged primarily to affect a permanent organization, and it is intended that its sessions shall be of particular interest to the Michigan business man. The topics for discussion have been selected with a view to this, and all speeches will be limited to five or ten minutes, in order that as many opinions as possible may be heard. A large number of those in the state interested in forestry, lumbering, railroading, etc., will be present, and the indications are that the meeting will be a successful one in every respect.

THE FOREST SITUATION IN CALIFORNIA

BY

GIFFORD PINCHOT

Chief, U. S. Forest Service

THE essential facts about the forest situation in California are three:

First, the state has passed a forest law, and under it a state forester of character and training has been appointed. Nothing could be more hopeful.

Second, good progress has been made in securing an area of land for government forest reserves more nearly sufficient than in many other states to protect and care for the interests which, in the absence of the reserves, must suffer.

Third, and most important of all, the necessity for forest preservation by wise use is more generally understood in California than almost anywhere else, and the people are more ready to act upon that understanding.

The comparatively favorable situation in forestry which these three facts indicate has not been brought about without vigorous and long continued effort by citizens of California. The Water and Forest Society, through the effective agitation it has carried on, and the vigorous campaign it has made before the legislature, as well as before the people of the state, is entitled to very great credit. Without the assistance of Governor Pardee much of the progress of the last two years would never have been made. The activity of the Sierra Club has been of great value. So has that of the Water and Forest Society of southern California; and individual men and women, far too numerous to mention here, have unselfishly and energetically given their time and effort to this paramount interest of the state.

To call the forest interest the paramount interest might, at first sight, seem unjustified; but if it is fair to

call an interest paramount when nearly all of the other interests of the state depend directly upon it, and must suffer if it suffers, then certainly the forest interest of California is paramount. Without its forests, the great interests of the state in irrigation would dwindle and fade. Without its forests, the mines of California would cease to be operated; the railroads would either stop running or they would be run at almost prohibitive expense. Of course the vast lumber business of the state would vanish. Stock raising without the summer range in certain of the forest reserves would be impossible in its present form. In a word, in California and in every other timbered mountain state, it is the forest which underlies the general prosperity, and California is most fortunate in having an understanding of this great fact so widespread among its people.

One most fortunate outcome of this public feeling, if I may be allowed to call it so, was the coöperation which the state undertook with the Bureau of Forestry of the United States Department of Agriculture more than two years ago, and which is to be continued for two years longer. Among the results of this coöperation, many of which are almost ready for publication, are a forest map of the state, with descriptions of the different types of forest trees; studies of the sugar and yellow pines; studies of the functions of chaparral in its relation to the reproduction of the forest; studies of the reproduction of timber trees; and a very important study of forest fires, and of the means for preventing them.

In addition to these results, there are others less well defined but not

less important. As a single example: lumber companies have become interested in conservative lumbering as a result of the coöperative work, and several of them have either adopted systems as a part of protecting their lands from fires, or are on the verge of doing so.

During the next two years the stud-

ies of forest fires and of important lumber trees are to be continued, while the tests of California coast timbers, already under way at the State University, will be continued and extended. Special attention will be given to questions of tree planting, and further studies of the effect of the forest on water supply will be made.

WORK OF THE RECLAMATION SERVICE IN CALIFORNIA

BY

F. H. NEWELL

Chief Engineer, U. S. Reclamation Service

THE State of California, with its immense area and diversity of physical conditions, has offered tempting opportunities for investigations and survey by the Reclamation Service. At the same time, the relatively high state of development of the arid portions of California have resulted in a complication of private rights which have made construction by the government notably difficult. California has been the pioneer in irrigation development, and being in part humid and part arid, it has been for years the battle-ground between two radically opposite and contending ideas regarding water ownership. The complications which have resulted are such that the government in its large work has been compelled to proceed with great caution.

Throughout the state irrigation development has proceeded rapidly and individuals and corporations have built many large works. California, especially the southern part, has for several years offered examples of elaborate hydraulic construction, and students of irrigation, as well as experienced engineers, have come from abroad and from all parts of the arid west to study the examples there to be found. On the passage of the Reclamation Act of June 17, 1902, con-

ferring authority upon the Secretary of the Interior to construct large works in California and elsewhere, it was apparent that any such construction must be very carefully considered with reference to all vested interests.

The extent and ramifications of these vested interests is a far more difficult fact to be ascertained than many of the physical conditions. It is possible to survey reservoir sites and bore for foundations for dams, obtaining promptly and with certainty the physical conditions; but to ascertain the title to or ownership of the land which may be involved in the work, and particularly of the waters, is by no means as direct a matter, and frequently long and vexatious litigation must ensue before the essential conditions of ownership can be established.

The irrigation resources of California were by no means unknown on the passage of the Reclamation Act. Since 1888 the Hydrographic Division of the Geological Survey had been systematically studying the opportunities; had measured streams, surveyed catchment areas of the rivers in the mountains; had made maps of portions of the irrigable lands; had ascertained the flow of many of the important sources of supply; and, in short, had brought together many of the es-

amentals as to the extent to which the arid lands might be reclaimed. With this large mass of information at hand, supplemented by further studies, the Reclamation Service has endeavored to pick out the localities where the largest results might be obtained and the public most benefited. It so happens that the conditions were most favorable on the extreme north and south. The Colorado River, the largest stream of the arid region, was first considered. Maps were made of the irrigable land in the valleys along its course and full consideration taken of the opportunities presented. As a result, the so-called Yuma project was first worked out and presented for approval of the Secretary of the Interior.

In the far north, and lying partly in Oregon, is the Klamath project, where there is also an abundance of water and a vast extent of arid land. Here, also, the conditions seemed most favorable for producing prompt results, and in turn the Secretary of the Interior has conditionally approved construction.

At about the center of the State and east of the great mountain range, there was found to be, in the Owens Valley, an excellent body of irrigable land with a somewhat uncertain water

supply. Here, also, there appeared to be an opportunity for successful reclamation and efforts have been concentrated on ascertaining the available supply preliminary to considering construction.

The great problem of the future, however, as regards the entire state, is the best use of the water of the great interior valley, including the Sacramento on the north and San Joaquin on the south. After results have been attained at Yuma and Klamath, it is believed that the storage and control of the headwaters of the Sacramento and San Joaquin is the greatest which can be undertaken by the government and by the state. As preliminary to such operations, it is necessary to obtain facts as to river flow extending over several years and to make surveys of almost innumerable reservoir sites and points of storage for diverting waters. For this reason investigations are being continued throughout the great valley of California, and it is hoped that upon the completion of the great projects on the north and south efforts may be concentrated toward the solution of the problem of river control in the interest of irrigation, and incidentally, in that of all other industries in the state.

REFORESTING IN CALIFORNIA

BY

T. P. LUKENS

THAT the first effort to reforest the mountain water-sheds should be made in Southern California, is natural, because there exists the greatest need, owing to the never abundant forest covering having been destroyed by irrational use, fires, and stock grazing. In consequence of the depletion of the brush and trees on the mountain slopes, surface streams have greatly decreased in volume, and in many cases the flow has entirely ceased

in summer, succeeding floods in winter.

The destruction has been on the increase until quite recently, while the demand for water has been rapidly increasing. Irrigation in any form is practically on but one acre in $6\frac{1}{2}$ acres of the arable land in Southern California, and the water is used to its fullest capacity. Not only is all stream flow used, but every effort is being made to secure water by tunnel-

ing into the mountains, sinking wells, and raising water by pumping at an enormous expense. The actual value of property in the seven southern counties of California, is over \$500,000,000. If there were sufficient water for all of the arable land, the wealth would be increased to approximately \$3,250,000,000. It is to secure as far as possible this great increase in wealth and make it possible for 2,000,000 people to build and maintain homes in the most delightful and beautiful spot in America, that has induced the United States Forest Service to undertake the difficult task of reforesting the mountains.

First of all in importance, and a matter that should precede planting operations, is a systematic preparation of the mountains by making fire-breaks. This is done by removing the growth from the main and most lateral ridges so as to confine the fires to narrow limits. This is being done, and as it is purely mechanical, completion is only a question of available funds. If only this were done and the danger of fire removed, the increased growth by natural methods would in many fold repay the outlay by the consequent increased water conserving power. There can be no water secured in Southern California for irrigation except that which falls on our mountains, and the quantity to be had for use in summer depends upon the character and density of the growth. What to plant, and how to care for that which is planted, is a problem the Forest Service is studying with great earnestness.

In the selection of species for planting, we are keeping as closely as possible to nature. We note carefully what species she has planted on the various slopes; examine carefully the climatic and soil conditions and altitude where each species is found flourishing.

On the most parched and barren slopes chaparral is best adapted. Chaparral is of great value in preventing erosion, to some extent cooling the surface, and acting as a nurse for the trees, which must be returned to the

water-sheds to insure a water supply at all adequate for future demands. The factor that makes the task most difficult in reforestation, is the slight rain fall.

During the winter of 1902-'03, we planted a large quantity of seed in small beds over the mountain slopes. The rain was sufficient to germinate the seed, but the rain ceased early in March and no more fell until February, 1904. Many trees were living six months after the rains ceased, but at the end of eleven months of drouth, but few were left. Besides the long dry spell, an infinite number of small creatures, such as rabbits, linnets, and rats, preyed upon the little trees. We did not feel so badly over this loss when we observed that of all the billions of seed sown by nature after germinating and promising well, withered and died.

Passing over the stages of experiment through the drouth years, which have been of great value, the plan now is to grow the trees one summer under lath shade of $\frac{1}{2}$ density, where we can care for them; and during the winter months transplant them in beds in the open ground. During the second winter, the idea is to transplant on the mountain sides where they are to grow permanently, all the trees that are strong of root and top, and not less than 12 inches high. The weaker seedlings must be transplanted and kept another year under training. The main object in having them large is, that the rabbits, of which there are many in the chaparral, will cut the little seedlings off close to the ground. The larger trees may be cut off several times, but are well supplied with dormant buds, and will send out a fine spreading top.

Places are prepared for the trees where they are to grow permanently, by digging a space $1\frac{1}{2}$ or 2 feet across and 1 foot deep, if possible on the north side of a bush. The spot is marked by tying a rag on the bush nearest the bed, to enable the planter to find it. These beds are made in the fall or early winter that the ground may have time to settle. As soon as

rains have wet the beds thoroughly, trees are carried in deep cans or pails in which there is sufficient water to submerge the roots, and but one taken out at a time. To permit the roots of conifers to dry is to destroy them. The tree must be planted carefully, and the dirt well packed about the roots, leaving the tree in center of a little basin which we fill with litter or mulch, to assist them in weathering the long dry months. It will be useless to plant late; they must have the benefit of the winter rains to establish a good root growth.

In selection of species, little regard is paid to their economic value as a lumber tree. What is needed is a great mass of large roots to form innumerable dams beneath, and a spreading dense growth to shelter the surface from sun and wind to prevent evaporation.

For the most exposed and desolate slopes we plant the knob cone pine (*Pinus attenuata*), indigenous on the poorest, hottest slopes of the mountains from the San Bernardino to Shasta. It has the commendable trait of holding its seeds hermetically sealed in cones for the future, and the calamity that causes the death of the tree, liberates the seed to plant a greater area than existed before. The big cone spruce which once covered the greater area of our mountains below 5,000 feet, and is indigenous only in

Southern California, is in great favor and will be used largely. Also the big cone pine (*Pinus Coulteri*), is desirable to plant with the above two species, on the hard places. On northerly slopes the incense cedar (*Libocedrus decurrens*), is used, also oaks. Above 5,000 feet we can use the various forms of yellow pine (*Pinus ponderosa*), sugar pine (*Pinus Lambertiana*), shore pine (*Pinus contorta*), and lumber pine (*Pinus flexilis*), though but few species will grow out of the zone in which we find them. However, the incense cedar, big cone, and knob cone are grateful for the opportunity to grow at any altitude.

We are experimenting with a few each of many exotic species of brush and trees; especially promising at this time are found to be deodar cedar (*Cedrus deodara*), Jerusalem pine (*Pinus halepensis*), and maritime pine (*Pinus maritima*).

Only long patient study and hard labor can bring success in this work. There should be funds for more extended and thorough work. The past winter has been favorable, as a good rainfall distributed over six months has rendered the trees planted last winter are promising well.

It is gratifying to know that the Department has faith in the ultimate success of our efforts to reforest, which they have shown by establishing other nurseries.

GENERAL OUTLOOK FOR RECLAMATION WORK IN CALIFORNIA

BY

J. B. LIPPINCOTT

Supervising Engineer, U. S. Reclamation Service

THE work of the United States Reclamation Service in California, at the present time, is confined chiefly to three principal areas, namely, the valleys of the Lower Colorado, Klamath, and Sacramento Rivers.

The Yuma project on the Lower Colorado River includes the valley lands of the Colorado and Gila Rivers

in the vicinity of Yuma, Arizona, and portions of the Yuma Mesa which it is proposed to irrigate by pumping.

The Laguna Dam for regulating the water supply and controlling the silts of the Colorado River is to be of the Indian weir type, built of loose rock with cut-off walls of concrete and sheet piling. The dam site is about 12



miles above Yuma, where the river flows between two low walls of solid granite, and is the lowest site on the river where solid rock for spillways and abutments can be found. The total length of the dam is 4,780 feet, and the maximum height above low water is 13 feet. The settling basin formed by this dam will be approximately ten miles long, with an average width of two miles. Water will be drawn into the irrigation canals from the surface of this reservoir. The heavier sands and silts which settle to the bottom will be disposed of by sluiceways through the abutments of the dam, and below the grade of the regulating gates.

The overflow lands of the valley will be protected and the flood waters of both the Colorado and Gila Rivers controlled by means of dykes on either side of the stream.

The total area of irrigable valley lands on the Yuma project is approximately 90,000 acres, and the area of mesa land proposed now to be irrigated by pumping, from 20,000 to 25,000 acres. The reports of the Department of Agriculture on the Yuma lands show them to be very fertile. The silts of the Colorado River, which cannot be all removed, act as a fertilizer to constantly enrich the soil and keep it in a condition for a high state of cultivation. The climate of this area is such as to permit of the growing of certain crops throughout practically the entire year. Citrus fruits can be grown on the mesa under the proposed pumping system.

The sum of \$3,000,000 has been set aside by the Secretary of the Interior for the construction of this project. The contract for the construction of the Laguna dam has been awarded by the Secretary of the Interior to J. G. White & Co., and it is expected that actual construction work will be begun at an early date.

The Klamath project is situated in Klamath county, Oregon, and in Modoc and Siskiyou counties, California. It includes the valleys of Lost River

and of the upper portion of the Klamath River. The watershed area above the Klamath basin extends from the Sierra Nevada Mountains on the west to the Warner Mountains on the east, and north to Crater Lake. It includes within its area the Klamath Indian Reservation. The principal streams which drain this area are the Williamson and Sprague Rivers which empty into Upper Klamath Lake, and Lost River which empties into Tule Lake.

Upper Klamath Lake, together with its marginal swamp lands, has an area of about 100,000 acres. It is the headwaters of the Klamath River, and acts as a storage reservoir for regulating the flow of that stream.

Tule Lake, which receives the drainage of Lost River, has an area of over 90,000 acres. It is situated on the boundary between California and Oregon; it has no outlet.

Clear Lake, which with its marginal swamp lands, has an area of about 15,000 acres, is situated at the head of Lost River and is fed by Willow Creek. This lake acts as a storage reservoir in controlling the flow of Lost River, water flowing into it during the flood season, and out of it during the low stages of Willow Creek.

Lower Klamath Lake, also situated on the boundary line between California and Oregon, has, with its marginal swamp lands, an area of about 90,000 acres. Water flows into this lake from the Klamath River during flood periods of the river, and in the opposite direction when the river is at its lowest stages. A short distance below Lower Klamath Lake the river begins a series of steep rapids.

The peculiarities of the topography of this region, lend itself in a remarkable way to the economic reclamation and irrigation of this project. It is proposed to lower the waters of the Klamath River by a cut at the head of the rapids below Keno, sufficient to practically drain Lower Klamath and the marginal swamp lands, thus making them a part of the reclamation pro-

ject. The greater part of the water supply of Lost River will be conserved by storage, and used for irrigation. The flood and waste waters of this stream will be diverted from Tule Lake to the Klamath River, thus cutting off the water supply of this lake, which will rapidly shrink by evapora-

the irrigation of the Upper project, which includes Langells, Yonna, Upper Poe and Upper Klamath valleys, having an estimated net area of 48,356 acres.

For the irrigation of Klamath Valley, including the beds of Tule and Lower Klamath Lakes, the water sup-



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tion and uncover large areas of irrigable lands.

Clear Lake and Horse Fly reservoir sites will be used for the storage of the present waters of Lost River. The former of these has a capacity of 462,000 acre feet, and the latter 157,000 acre feet. This water will be used for

ply of the Klamath River will be used; the diversion being made from the Upper Klamath Lake which will be used as a storage reservoir. The estimated total area irrigable from the Upper Klamath Lake is 188,045 acres, giving a total area of 236,401 acres in the entire project; of this area 90,000

acres are in California and 146,401 acres in Oregon. About 45 per cent. of this area is still public land.

Surveys on this project were begun during the summer of 1904. Preliminary plans and estimates on the project have been prepared and approved, and the Secretary of the Interior has set aside the sum of \$4,400,000 for the construction of the project.

The Sacramento Valley project contemplates the irrigation of the entire Sacramento Valley, so far as can be done without interference with navigation. The total area of this valley, exclusive of the Sutter Buttes and the channel surface of perennial streams, is 2,660,500 acres; of this amount 1,978,200 acres are above all overflow. Approximately 40,000 acres are now irrigated, while the area that can ultimately be irrigated probably exceeds 2,000,000 acres.

It is with a view of determining the most feasible plans for the irrigation of this vast area, that a study of the Sacramento Valleys has been undertaken upon the following lines: The Topographic Branch of the United States Geological Survey, in coöperation with the State of California, has undertaken the mapping of the entire floor of the valley, the Geological Survey having complete charge of the work, and the state paying one-half of the expense. The surveys for the portion of the valley west of the Sacramento River will probably be completed within the present year.

The Hydrographic Branch of the Geological Survey has established gaging stations on all the principal tributaries of the Sacramento, where the flood can be measured from 82 per cent. of the entire drainage of the basin. The drainage area tributary to this valley is approximately 26,000

square miles, and the estimated annual run-off is nearly 26,000,000 acre feet—enough to cover the entire floor of the valley over nine feet deep. The flow of the river from May to September, inclusive, is less than 24 per cent. of the total annual flow, a fact which shows the necessity of storing the winter flood waters.

For the purpose of storing the flood waters, six reservoir sites have been located and surveyed on the coast range streams, which enter the valley from the west, five sites on the Pit River and tributaries, and one site on the main Sacramento River at Iron Canyon above Red Bluff. Surveys are now in progress in the Puta Creek and Feather Rivers basins, where reservoir sites are known to exist.

The Forest Service of the Agricultural Department has taken up the study of the forest cover of the drainage basin and has made extensive withdrawals of the remaining public lands for forest reserve.

A Board of Army Engineers has been appointed to continue the study of the flood and overflow conditions of the Sacramento, together with the navigable capacities of the stream. This work is closely allied to the reclamation work as the construction of storage reservoirs will assist in the solution of both of the questions by taking care of the flood waters during the winter season, and preventing overflow, and by providing a supply whereby the summer flow may be maintained for irrigation, water power and navigation.

In conclusion, it may be said that California has before it a great work for the reclaiming of its arid lands, and that the Sacramento Valley presents one of the greatest, if not the greatest, opportunity for irrigation development to be found in the west.



FOREST FIRES AND THE FOREST IN THE CALIFORNIA SIERRAS

BY

WILLIAM F. HUBBARD

Late of the U. S. Forest Service

THE question of fires and their relation to the forest, future and present, is to a great degree occupying the minds of all those who are interested in the forest problems of California. The discussion of means to prevent the vital danger of forest fires has waxed strong in the press and forestry meetings. Many of those who consider the question of fire protection seem to favor a return to the so-called Indian method—in other words to repeated burning of the entire forest floor to prevent the accumulation of debris and consequent serious fires. When this is stated, in broad lines and with no saving clauses, the trained forester is bound to take exception to the entire argument. Yet when the case is presented fully and from all points of view, there is a broad meeting ground for every one concerned where a general policy may be decided on, satisfactory to all.

The first necessity is a clear statement of all the involved points. "The preservation of the forest from serious fire by a return to the old Indian burning" is a phrase most often heard in discussions bearing on the subject. It is argued that the Indians solved the secret of forest protection when they thus kept the forest clean of litter by repeated fires. That they prevented a general conflagration is at least likely, but before their system can be accepted as worthy of imitation we must attempt to determine whether it is the best feasible method which will do most to improve the yield and quality of the timber, and enable the forest to bear the drain put upon it both by the present and the future.

The proper exploitation of the

woods for civilized needs requires a more or less intensive system, and to contend that the Indian was acquainted with the principles of forestry is quite as preposterous as to say that the Indian of the middle-western plains was an agriculturist. To the savage the forest is but a collection of trees and a mere item in his surroundings, like the hills, precipices, and rivers. To civilization, the forest is a source of one of those great staples of supply which makes communal life possible, and, like all such, it bears a continually increasing value with the growth of population. From this it is quite evident that the Indian method must be of peculiar value, and clearly understood to its minutest details, if it is to be applied to the use of present complicated economic conditions. Nevertheless this much lauded system can only be stated in very broad lines and coupled with the most sketchy generalities.

That the Indians burned the forest floor is both the beginning and the end of the argument. But what is the method in detail? In what manner did the Indians burn and what was their object? To these definite questions come only the vaguest of answers. One of the leading San Francisco papers stated editorially that the lack of disastrous fires this summer was due to the fact that the woods have been entirely burned over in late years, and there was consequently nothing left to burn. Such is the opinion of a large per cent. of those who discuss the fire question. Added to this battalion of office table theorists is the regiment of old inhabitants. Those who have "lived in the woods for forty years, young man," and

should therefore know what they are talking about.

This paper will confine itself to northern California, and will attempt to prove in this region: first, that the Indian forest burning did untold harm to the forest, and, second, that such a method is absolutely indefensible for present conditions which call for the most careful and scientific regulation of fires.

INDIAN FOREST BURNING AND ITS EFFECT.

The trees themselves are witnesses to continued fires which have swept the California forests for an unknown period. Nor is there any doubt that most of these fires may be traced to the Indians.

A savage and nomadic people is mainly dependent on the chase, and in the lack of efficient weapons there is



Fig. 1. Old virgin forest replacing itself where fires have been absent

nothing better than fire as a method of driving game or of opening the forest that hunting may be easier. To this may be added the extreme likelihood of accidental fire. Small hunting parties, wandering through the mountains, gave infinite chances, in their utter carelessness, to spreading conflagration. In this manner, between design and accident, it is easy to see how a forest, tinder dry for five months, could be largely burned over in the course of a short period, and thoroughly swept of debris.

workers in natural science, and must, perforce, be acceded to the forester.

The forests of the Sierras and Coast Range are composed of trees which grow with great vigor and which are mostly plentiful and regular seeders, showing themselves in every way adapted to the soil and moisture conditions. From this it follows that the trees normally grew in close order and formed a continuous forest cover. When the stand of timber in any locality waxed old and commenced to grow open in its decline, a young for-



Fig. 2. Open forest with chaparral ground cover as result of continued fire

Granting, then, the prevalence of Indian fires and the partial cleanness of the forest floor as an effect, let us go on to determine at what cost this result was obtained.

Forestry would not be an art could it not study the present forest and from it give a fairly accurate picture of its original before it fell under the touch of man. Similar powers in their line of work are acceded to the geologist, the biologist, and other

est immediately began to take its place, and the dense cover was re-established. Where fire, fed by lightning, or where the hurricane made an opening in the timber, a young even-aged stand succeeded to the old, and grew in luxuriance.

There is every reason to think that this forest was unbroken over the entire region where soil, temperature and moisture conditions allowed the component species to make their best

growth. Into this heavily wooded area, containing vastly greater quantities of merchantable timber than today, the Indian came at a period anthropologically by no means remote, and the fires, kindled by him for the chase, or by accident, commenced their untrammelled sway. In a virgin forest of large-sized trees, even in so combustible a region as the Sierras, absolutely destructive conflagrations would not be the normal form of forest fire. But a continual procession

stretches which escaped damage for many years at a time. In this type of forest there is a heavy stand of timber, and it is either heavily stocked with mature trees, or if the old veterans are deteriorating, there is a large quantity of young growth filling the openings and taking their places. Many parts of this class of timber have almost escaped fire entirely, and show the normal type which should exist throughout the entire region on similar situations. Fig. 1 gives a fair specimen



Fig. 3. Open chaparral field, the result of continued fierce fires. Splendid view of Mt. Shasta in the distance.

of surface fires of more or less intensity do the deadly work of forest destruction with even greater efficacy.

At the present time the Sierra forests may be divided into three broad types in regard to their fire history.

1. *The denser timber.*—Fire being most destructive to the forest when it occurs periodically at short intervals, those areas where the visitation is not constant must be in the best condition. In a region so large as the Sierras and so mountainous, there must be large

of the forest and its renewal under the old timber when it has a fair chance. Nearly all the valuable timberlands of the Sierras are in this type, which gives the state one of its greatest sources of wealth. The major part of this dense forest has suffered more or less heavily from fire, but it is generally in fair condition, and in itself, not being liable to severe fires, is not difficult to protect and manage.

2. *The open forest.*—Unfortunately for the economic value of the Sierras,

the dense forest is comparatively limited, and a great area is given over to an open stand of timber, growing in a ground cover of dense chaparral. This open forest has poor timber, both in quantity and quality. It is quite certain that this deterioration in value has been brought about by continued fire, and that without such repeated burning the forest would have been quite as dense and valuable as neighboring regions which suffered less severely. A continual procession of

forest flow. The result is typical of great areas (Fig. 2). An open stand of over-mature and deteriorating trees above, and beneath a dense growth of chaparral interspersed with scattering poles and saplings which have escaped the repeated fire. For this and the succeeding class of its forests, California is indebted to the system of Indian burning.

3. *The chaparral field.*—In places where the fires have been fiercer and more regular, the picture is still more



Fig. 4. How an open chaparral field increases its bounds (Compare with Fig. 1)

surface fires of more or less intensity, running through the deep litter of the virgin forest burned out the younger growth, but left most of the larger trees standing. This burned ground is a natural seed bed, and at the next seed year the little trees would begin to appear. Another fire, however, would sweep most of them away, and the chaparral, previously kept in check by the dense cover, but quick to mature and a vigorous sprouter, begins to gain a dominating position in the

dismal. Here the reproduction has failed entirely, and, the old trees gradually burned down or dying of old age, the ground is given over entirely to an impenetrable growth of chaparral. Figs. 3 and 4 picture a scene common enough through the mountains. There is not the slightest doubt that this land was once heavy forest and acre for acre should be as valuable a possession to the state as any of its natural wealth. Yet as such fields stand to-day, they are not only a nega-

tive quantity in the economic forest, but also an active factor of harm. They are the homes of fierce intermittent fires which sweep with fury through the oily manzanita and ceonothi, each time sallying further into the surrounding forest. Nearly always these open fields are surrounded by patches of dead timber or a sparse open forest receding before the continued attack. Fig. 5 shows this unequal struggle in action, and figure 4 shows the result in detail.

At least 21 per cent. of the potential forest area of the Sierras is given over to this entirely useless growth.

lem in the mountains. The old Indian forests of the entire state. Under these circumstances how can promiscuous burning be of use?

THE FOREST FIRE PROBLEM.

Before lumbering commenced it was impossible for debris and litter to accumulate to a really alarming degree. If continual burning created the great chaparral fields, which are such a menace to the safety of the forests, before there was any great amount of debris in the forest, how much more dangerous must fire become after lumbering has commenced on a large



Fig. 5. Fire running from open chaparral field into green timber.

Summarizing the points given above:

As a result of continual fires set by Indians, the valuable forests of the state have been reduced to a relatively small area and great stretches of country given over either to a scanty low grade forest or to a worthless growth of chaparral.

This forest burning originated by the Indians has been kept in action by the carelessness of white settlers, so that the destruction is constantly continuing and is becoming a menace to

scale? In the train of every logging operation follows a wide area of heavy slash generally mixed with chaparral and so inflammable that fire sweeps through it with uncontrollable fury. Luckily, these areas are not yet of great extent, or continuous for a long distance, so that the danger lies not so much in the present as in the future. As logging goes on, and the lumbered areas grow greater, the menace from fire becomes the most important problem. Indian fires may have been bad for the forest from a silvicultural standpoint.

by gradually reducing the density and quality, but the modern slash fire threatens every industry in the region. Logging on a large scale has just begun in the California Sierras. In ten years the amount of cut-over land will be a large per cent. of the present merchantable forest. As the trees are large and heavy crowned, the slash is very heavy, and if it is allowed to lie, as at present, a fire in such a logged area means not only the utter destruction of all reproduction on the

and by the adoption of methods absolutely in accordance with the true state of affairs.

1. *Fire sentiment.*—The State of California has an excellent fire law recently passed by the state legislature. If every citizen makes it his duty to live to the letter of this law, and comply with its demands the greatest step toward the solution of the problem will be made. At present the idea is far too prevalent that fires are a necessary evil, and the problem of combat-



Fig. 6. The same type of forest as shown in Fig. 2, where fire has been absolutely excluded for 20 years. Reproduction nearly perfect.

land itself, but also the destruction of green timber about it.

It is to the advantage of the State of California to see that a second forest replaces the one now being cut on such a large scale. This statement is so apparent that it is hardly worth making, save to emphasize the necessity for fire protection. Only in intelligent fire regulation is it possible to keep the forest in existence, and work to that end is the duty of every Californian. This may be brought about by a universal sentiment against fires

ting them too insurmountable to be worth attempting. This is most assuredly not the case. All fires have small beginnings and prompt attention will reduce the number of disastrous burns an appreciable extent. Hearty and general coöperation with the fire officers and universal care in the fire season will make laws a success which otherwise will remain a dead letter.

2. *Methods of fire regulation and control.*—One of the greatest objections to the plan of fire protection by

burning the forest floor is the fact that it does not consider the many phases of the question but attempts to force one solution on several problems. There are at least three distinct variations in the question. (a) The protection of virgin timber, (b) the protection of old logged land, and (c) the protection of land as it is logged from year to year.

(a) *The Protection of Virgin Timber.*—It is to the advantage of all

the cover of the present trees, and in a forest successfully protected from fire there should be plenty of young growth to take the place of old trees when they are removed. (Fig. 1.) In the open type of forest, fire protection is still more important. This type has been potentially lowered by repeated burning, but there is no doubt that a cessation of fire will result in a successful reproduction even in the midst of chaparral. This is very bril-



Fig. 7. Logged yellow pine with young growth left standing.
Fire protection absolutely necessary

to see that lands which have not been logged are rigorously protected from fire. Apart from destroying young growth, continual fires burn out the bases of the old timber and lessen the value of saw logs. In some places the average damage from this cause rises to as much as ten per cent. of the value of the trees affected. This is serious enough, but even greater is the damage to young growth. Reproduction is always more certain under

liantly shown in the neighborhood of Placerville, Eldorado county. About fifty years ago the forest was very open, and the ground cover largely chaparral. In the sixties a considerable part of the country was taken over by ranches in such a manner that many good-sized areas of this open forest were quite inclosed by them. In these places there was no fire, and as a consequence a complete reproduction has occurred. (Fig. 6.)

In these dense thickets one may still find the roots of manzanita and ceonothi and see the scare of old fires on the seed trees. There could not be a better example of the results following an exclusion of fire.

The best method to bring about such an end is a systematic fire patrol and a system of telephone stations for reporting fires and calling assistance. Fire in this type is not difficult to check, especially if it is taken early. The Diamond Match Company has

the hopeless class of the chaparral field. On the unburned land of this type there is almost always good reproduction and in many places it is quite remarkable. In almost every instance, however, the young growth is heavily interspersed with chaparral and debris. Fig. 7 shows a good example of such land. With adequate fire protection there is no doubt of this becoming an excellent young forest in which the chaparral will be almost wholly excluded. (Fig. 9.) At



Fig. 8. The same forest as Fig. 7 after fire; the destruction is total.

instituted such a system and finds that it bears excellent results at a reasonable cost.

(b) *The Protection of Old Logged Land.*—Although this area is not large in comparison to the total forest it is nevertheless of sufficient importance to justify separate discussion. Strange to say only a limited part of these logged lands have been burned, but where this has occurred the destruction of young growth has been total and the tracts are reverting to

present it is peculiarly liable to conflagration and the mixture of slash and chaparral is a certain agent of destruction. Fig. 8 shows the lumbered land through which fire has run. Every seed tree and sapling has been destroyed and there is no future for the tract but reversion to chaparral. In the case of the land shown in Fig. 8, the fire not only destroyed the future of the logged land, but gained such impetus that it ran into neighboring green timber and destroyed a large

area. There is, therefore, a two-fold object in the regulation of fire on old logged lands.

As the slash is mixed with valuable young seedlings which have grown through it, general burning is not feasible, but protection may be brought about by a dual system of fire lines and fire patrol. The fire lines should be laid out at a proportion of about one mile per section, and made to take advantage of all favorable situations. They are not fire lines in

should give efficient protection. This system is being worked out for the McCloud River Lumber Company, and is estimated not to cost over three cents per acre for the area protected.

(c) *The Protection of Land as it is Logged.*—It is to the advantage of all to see that the area of dangerous logged land shall not be extended. To this end the slash must be burned each season after logging. This burning, however, must be carried on with regard to the young growth left stand-



Fig. 9. Chaparral conquered by yellow pine which originally grew under conditions shown in Fig. 1. Fire danger slight.

the strictest sense of the word, but merely strips three or four hundred feet wide along which all stubs have been removed and all debris burned as clean as possible. They are not cut clean of green brush, but are intended merely as places where a back fire can be set without danger of its running in the wrong direction.

Such lines should not cost on the average over twelve or fifteen dollars per mile, and, combined with a patrol

ing. In several parts of the Sierras attempts have been made at slash burning, all of which resulted in the utter destruction of the forest for years to come. Experiments at McCloud last year showed that by a little more careful falling and swamping, the tops and limbs may be grouped in such a way that most of the debris may be burned without doing great damage to remaining poles and saplings. A very small extra expense in

swamping and burning will save large quantities of small timber which will have considerable value in a few years. At McCloud, it is estimated that the logged lands will have on an average of 8,000 feet B. M. per acre in forty years, if they are protected from any fire except the careful burning which removed the slash. Such burning is quite different from that upheld by the advocates of the Indian method.

In conclusion it may be said that in all parts of the Sierras, where forest growth is economically worth encour-

aging, the valuable species tend to supplant the chaparral. After the young trees have passed a certain age they tend to supplant the underbrush, and are less likely to a great burn than is the chaparral. (Fig. 9.) As the chaparral in extended areas is the result of fire and as it is continually liable to fierce conflagration, it is the correct policy to make every attempt to reduce it by favoring the growth of commercial species. This end can only be obtained by the strictest and most intelligent regulation of fire and not by reckless burning.

WATER AND FOREST ASSOCIATION

An Organization of Public Spirited Citizens That Has Done
Much for the Higher Development of California's Resources

BY

T. C. FRIEDLANDER

Secretary, Water and Forest Association

CALIFORNIA to-day leads all states in the work that is being done to develop the irrigation of its lands. Under the United States Reclamation Act work is under way to place 100,000 acres under ditch from the water to be derived from the Colorado River. Another project under the Reclamation Act contemplates the irrigating of 236,000 acres of land situated partly in California and partly in Oregon. The greatest development, however, taking place and in contemplation, is in what is known as the great central valley of California, comprising the Sacramento and San Joaquin valleys. Southern California, owing to the absolute necessity of the situation, has hitherto made the greatest progress in irrigating land under advanced methods, and the use of water as practiced to-day in that section stands as an object lesson to all the world of what can be done in this direction.

Since about 1885 up to 1900, but little development had been made in the great central valley of California in the placing of water upon the land. What was known as the Wright Act, which enabled the formation of districts under a mutual plan for the purpose of acquiring a water supply and distributing the water to the lands of the district, had been tried and disaster had ensued in many instances. In the Wright Act there were two fundamental defects which caused its failure. The first was a clause enabling a district to be formed by a vote of all inhabitants of the district and not (as should have been the case) by a vote of the acreage. Districts were formed in which one-half of the acreage objected to the formation of the district, whereas the votes secured in the towns and villages within its borders were sufficient to override the wish of the land owners. A second cause of disaster was the operation of the clause

providing for the administration of the district, and frequently the men in control had neither the ability nor the training to allow them to successfully handle large undertakings.

The new era of irrigation development in the great central valley of Cal-

tion was the raising of the sum of \$12,000 to provide for what was considered the necessary preliminary investigations. These investigations were conducted by the Hydrographic Branch of the U. S. Geological Survey, to ascertain the flow of water in



Hon. JOHN G. NORTH
President of the California Water and Forest Association

ifornia practically dates from the formation of the Water and Forest Association, which was organized in 1899. It was apparent to those having an interest in the matter that there was a want of data upon which to build, and the first act of the Associa-

tion was the raising of the sum of \$12,000 to provide for what was considered the necessary preliminary investigations. These investigations were conducted by the Hydrographic Branch of the U. S. Geological Survey, to ascertain the flow of water in the streams, the available and economical situations for reservoir sites, and like data. Investigations were also conducted by the Irrigation Investigation Branch of the U. S. Department of Agriculture, to ascertain the duty of water and kindred subjects. The

United States government duplicated dollar for dollar the amount subscribed through the Water and Forest Association. The reports of the first year's work by these departments attracted universal attention and met with hearty approval. It was then the opinion of the Association that the state should continue this coöperative work. A bill was introduced into the legislature of the state of California, and at the session held in January and February, 1901, passed both houses, making appropriations for this purpose; but, unfortunately, the bill was vetoed by the then governor of the state. The Water and Forest Association felt that the irrigation development of the state was but arrested for a while and laid its plans to secure in the future from the state sufficient money to again inaugurate the work.

For two years a campaign of education was carried on, and as a result the legislature of the state of California, in 1903, passed a bill appropriating the sum of \$60,000 to be expended for coöperative work, as follows: Topographic maps, \$20,000; surveying reservoir sites and canal locations, \$15,000; forestry work, \$15,000; best method of distributing and using water, \$10,000, with the understanding that the United States government would duplicate, dollar for dollar, the amounts appropriated by the state. The United States government not only did this, but spent more money than did the state. The result of the investigations conducted during the years 1903 and 1904 were so satisfactory that the legislature of the state of California in 1905 made an appropriation for the next two years for the same purposes in the following amounts: Topographic maps, \$30,000; gaging streams, surveying reservoir sites, determining underground waters, \$20,000; investigating economic quality and purity of water, \$1,000; forestry, \$10,000; best methods of using and distributing water, \$15,000. These appropriations were contingent upon the expenditure of an

equal amount by the United States departments that were to make the investigations. This shows a net increase over the appropriations of the preceding years of \$16,000.

During the past three years there has been a marked increase in the irrigation development in the great central valley of California. Two districts alone in the San Joaquin Valley—the Modesto and Turlock Districts—comprise about 250,000 acres of land susceptible of irrigation, with perfect water rights and good supply of water. In the Sacramento Valley other projects have been practically completed that will enable the irrigation of a large acreage.

The handling of the water supply and the irrigating of the lands of the Sacramento Valley present such great possibilities that the attention of the officials of the U. S. Reclamation Service have been attracted thereto, and preliminary investigations are being conducted whereby this service may in the future undertake the work of placing under ditch 2,000,000 acres of as fertile land as can be found anywhere in the world. The investigations which are being conducted in the Sacramento Valley are along broad lines, which include a study of the forest covering of the mountainous portion of the entire basin, the exploration for survey of all reservoir sites and the establishment of gaging stations which will determine the available water supply for each of these sites, and the mapping in five-foot contours of the valley lands.

As the result of the coöperation by the state with the U. S. Departments, the Geological Survey is doing more investigation work in the state of California than in any other one state, and the same can be said of the work of the Department of Agriculture, through its Office of Experiment Stations.

The Water and Forest Association felt that no plan for irrigation development would be complete unless the natural reservoirs, consisting of the

slopes around the headwaters of the streams to be tapped, were properly protected. For that reason it devoted itself to the question of forestry and urged that the forest reserves of the state of California be materially increased. Many obstacles were encountered; in the Land Office in Washington itself and also in educating the people of the state of California to the necessities of the case. The work of the Water and Forest Association finally resulted in the withdrawal by the President of the United States in the year 1903 of all government land on the headwaters of all streams flowing into the Sacramento Valley. This meant a withdrawal of approximately 10,000,000 acres. Large quantities of this land have since been surveyed and such portions as were found unfit to be placed in a forest reserve were returned to the public domain. As fast as the surveys could be completed forest reserves have been made, and the next two years will see permanent forest reserves covering the watersheds of the streams in question. That the Bureau of Forestry has been enabled to accomplish so

much in the State of California is directly traceable to the coöperation by the State, as evidenced in the appropriations made by the past two legislatures.

In connection with forestry matters the question of fire protection has received the attention of the Water and Forestry Association. At its instigation the U. S. Bureau of Forestry conducted investigations which enabled them to prepare a bill providing fire protection in the state of California. This bill in an amended form was passed at the last session of the legislature of the state of California and received the approval of Governor Pardee. The legislature also passed acts enabling the different counties to take legal measures for fire protection, so that to-day California has, in the opinion of experts, as good laws on fire protection for its forests as exists in any other state in the Union. While the machinery is there, the laws have not been yet put wholly in force. This necessarily takes time; but in the hands of the energetic governor of the state of California another year should see the whole system in perfect working order.

THE IRRIGATION INVESTIGATIONS IN CALIFORNIA OF THE OFFICE OF EXPERIMENT STATIONS

BY

ELWOOD MEAD

Chief of Irrigation and Drainage Investigations, U. S. Department of Agriculture

THE attractions of country life in California will in time make it the home of a dense rural population. The seasons are marvelously adjusted to the farmer's needs. Rain falls in the winter when it is needed and is withheld in the harvest season when it would be an injury. The soil is remarkably productive and there few, if any, countries in the world where so

wide a variety of productions can be found on the same acre of land. The opportunities to enjoy life in the open, afforded by the mild and agreeable climate, makes the country attractive to others than farmers. The number of men of means, able to enjoy the best there is in life regardless of its cost, who are going to California to do this is every year increasing and

these men, as a rule, seek homes in the country. Hence, home-making in the country in California is being extended through two influences: the farmer and fruit grower who must make it pay, and the wealthy men of the cities to whom profit is a secondary consideration. With both classes, the expenditures on land in order to bring it to the highest state of cultivation, the beautifying of homes, and the land values themselves, are less dependent on profits in California than in any other part of the United States. This at present is shown more clearly in southern California than in the northern part of the state, but there is so little difference in the climatic advantages of the northern and southern parts of the state that in time the same influences will operate everywhere.

California now leads all the states in the extent of its irrigated area, in the value of irrigated land, and in the prices paid for water. It is a state where a large percentage of the new settlers are from the East and know nothing about irrigation methods. A knowledge of how to distribute water with the least waste, a knowledge of how to prepare land for irrigation, of how to apply water to secure the best results, has, therefore, in that state exceptional practical importance, and this fact has shaped the irrigation work of the Office of Experiment Stations in that State.

In southern California the water supply is limited and water rates are high. Every saving in the quantity of water used on an acre of land has a direct influence on the farmer's and fruit grower's profits. The cost of water at Ontario is about \$10 an acre under the duty now obtained, and the capitalized value of a cubic foot of water per second, based on an interest rate of 5 per cent, is not far from \$100,000. Hence, every additional acre which a given quantity of water will serve not only adds to the productive territory but tends to lighten in a marked degree the farmer's expenses.

This office is making a study in different districts of California of the method of applying water to crops best suited to their conditions. In the citrus orchards of Riverside, the soil is moistened through deep furrows and kept so by continuous cultivation. The furrow method is not at all suited to the soil conditions of much of the Imperial country farther south. There, copious and complete flooding gives the best result. In the northern part of the state, alfalfa can be irrigated most economically by means of checks, but checks are not well suited to rotation of crops. In view of the great future of this region, too much thought cannot be given to the working out of the kind of agriculture best suited to each section, and the adjustment to that agriculture of the irrigation methods suited to its crops and soil. The latter is part of the work of this office.

The greater part of the water used to irrigate orchards in southern California is pumped from wells. In the Pomona district, where pumping is being studied this season, there are about 145 pumping plants in an area of 300 square miles. Many of these raise water to heights of from 70 to 100 feet and the cost of performing this service represents a large part of the annual expense of raising crops.

There are many questions connected with the pumping of water for irrigation which farmers wish to have answered. The kind of motive power, the kind of pump, whether to have an individual plant or central stations from which the irrigators of a considerable area will be supplied, are examples which could be multiplied till the list became tiresome. The answers to these questions are affected by a great many conditions. The availability and cost of fuel, the character of the water supply, and the inclination or ability of communities to work together instead of maintaining the individualism which characterizes agriculture in regions of ample rain-

fall, are among the factors which must be taken into account.

Some of the conditions disclosed by these investigations bring out clearly how far agriculture has advanced from the time when men threshed grain with a frail and depended for travel on the slow-moving horse and cart. The irrigators of California have to be more than irrigators. They are dealing with questions that involve an expert knowledge of mechanics, of electricity, and of social and economic relations wholly outside the practical interests of the cultivator who farms where the rainfall is ample. Men's capacity is determined by what they attempt and achieve and it is not at all surprising that the irrigation communities that are having to deal with these broad problems show a general intelligence and civic capacity far above the average.

One example will be given of the kind of mechanical problems irrigation requires the farmers to solve. Eight miles north of Ontario is an electric power station, chiefly used to pump water for irrigation. The power is brought to the colony by transmission lines under 10,000 volts pressure. It pumps water from wells in the debris at the foot of the San Gabriel Mountains. This debris catches the water which comes down from the mountains and holds it practically in a covered reservoir. There are eight wells reaching down into this underground storage basin. A description of one will apply to all. The power which lifts water from this well is carried under a 2,200-volt pressure which runs a 50 horse-power horizontal induction motor capable of working continuously at a 60 horse-power output. It runs a vertical centrifugal pump placed at the bottom of a timbered shaft 140 feet deep, which is fed from a 12-inch tube well sunk 460 feet.

The farmers who depend on these and other wells not only have the settlement of the types and kinds of power which they shall select and which they can afford to employ, but

they have to consider their relation to the ownership and stability of this underground water supply. The extension of pumping has caused a progressive lowering of the water plane of this region. In some localities the water level has fallen steadily at the rate of 10 feet per year. The water which fills the Gage Canal at Riverside was originally furnished almost entirely by flowing artesian wells. Gravity filled the canal. Now the lowering of the water plane requires 30 cubic feet per second to be pumped and has raised the cost of irrigation per acre from \$2 to \$7.66.

The progressive lowering of the water plane, partly due, no doubt, to a succession of dry seasons, has made the question of rights to underground waters almost as important as rights to surface water and has brought up a new class of legal and economic questions connected with water rights. One of the duties of this office, as defined by Congress, is to investigate and report upon the laws affecting irrigation and upon institutions relating to irrigation. California is one of the most interesting and fruitful fields for these studies. At present, however, the chief purpose of the work is to devise improvements to lessen losses from seepage and evaporation so as to postpone controversies over rights. This can be best done by lessening the quantity of water required for each acre irrigated, and this is the problem to which the office is addressing itself particularly during the present season.

Irrigation and drainage are two parts of a single problem. Drainage always has to supplement irrigation where seepage water or excess of alkali makes an accumulation of soil water a menace to continued productivity. Measurements of the rise of soil water, measurements of seepage losses, and surveys of areas requiring drainage, are being carried on in various parts of California where the reclamation of swamped and alkali lands is now, or will in the future be, an important productive factor.

CALIFORNIA'S FOREST POLICY

BY

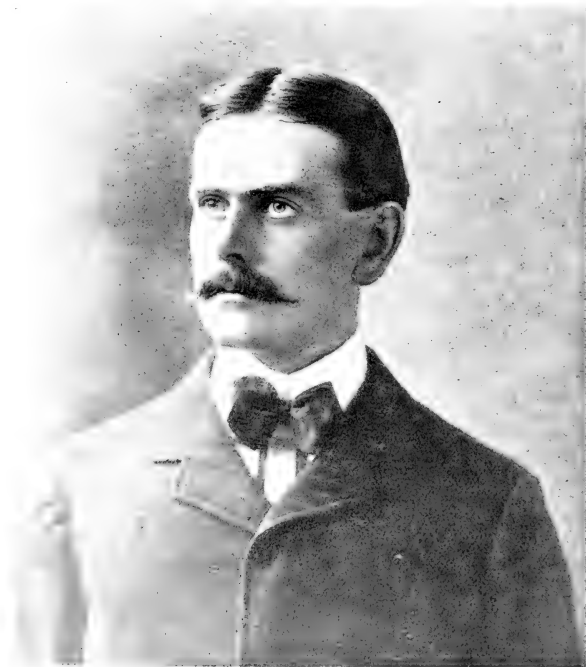
E. T. ALLEN

State Forester

THE immense area and diversity of the California forests and the large industries dependent upon them; the indispensability of irrigation, and therefore of forest protection, to agriculture; and the prevalence of forest fires and destructive lumbering methods, combine to make forest preservation in California not only of vital importance, but a problem of unusual difficulty. In a territory so large, and with such variations of altitude and

climate, conditions differ perplexingly, and many important interests are hard to reconcile.

The necessity of some action has long been recognized. Forestry agitation began with the settlement of the state, and over 20 years ago a Board of Forestry was created by the legislature, with fairly adequate provision for its work. Some valuable results ensued, but question of the thorough utility of the organization



MR. EDWARD T. ALLEN
State Forester of California

led to its abandonment after eight years of existence.

For ten years following, progress was slow. Interest in the subject continued to increase; the more rapidly as irrigation developed, destruction increased, and the mountains became the resort of immense numbers of health and pleasure seekers; but there was lack of practical organization. Appeals were made by clubs and individuals and several laws were on the statute books, but there was little provision for their enforcement.

These conditions prevailed until the present state administration came into power, when Governor Pardee, a man of unusual public spirit and foresight, became actively interested, and an arrangement was made for a study of the problem by the Bureau of Forestry, the expense of which was borne jointly by the state and the Department of Agriculture. Besides the accumulation of much valuable scientific and practical information concerning forest conditions, this resulted in the passage by the last legislature of a bill creating a Board of Forestry, and providing for a state forester and two assistants. This act also contains

several unusually well drawn sections for the prevention of fire, a notable one authorizing state forest officers to draft citizens for fire fighting without compensation and fixing a severe penalty for refusal.

Since this act has but just gone into effect, and organization thereunder has hardly begun, it is too early to record results. The policy, however, will be to make fire protection the important feature at first. Wardens will be appointed as fast as possible, and every effort made, by practicable demonstrations of fire-lines and patrol in selected localities, and by giving wide publicity to the laws, to arouse public opinion to a fuller realization of both the possibility and necessity of fire prevention. Enforcement of the fire laws will be strict, but with allowance, when necessary, for the local conditions and methods which often make well-meant but too sudden and drastic reforms unproductive of good. The development of planting and technical methods of forest management will follow, but will be considered secondary in importance until better assurance of fire protection warrants the expense they may involve.

FIELD WORK IN IRRIGATION

Work of the Office of Experiment Stations in California in 1905

BY

SAMUEL FORTIER

Irrigation Engineer in charge Pacific District

ELWOOD MEAD, in addressing the International Engineering Congress at St. Louis in 1904, remarked that "irrigation is a many-sided subject." Those of us who have had to do with the different branches of this subject in western America during the past twenty years realize the truth of this statement. In laying the foundation of so vast an industry,

the builders of a quarter of a century ago had but a crude idea of what the super-structure would prove to be. In their minds irrigation consisted of diversion dams and ditches, and the task each community set about accomplishing was to divert water from a nearby stream on some uncultivated, but fertile, mesa. Brimful of hope, they imagined that with the completion of

this task their chief difficulties in the irrigation of their farms would be overcome.

The history of the vineyards of Fresno, the alfalfa fields of Modesto, or the citrus groves of Riverside in this state, reveals a truer conception of what irrigation really is. It is true that dams have to be built and canals excavated at great expense, and this engineering side of irrigation is destined to occupy a prominent place so long as the water resources of the West are undeveloped. But if our

which have to deal with the settlement of water rights and the equitable distribution of water. Finally, there is that wide and profitable field of investigation which is now attracting so much attention, viz: the proper use of water on cultivated fields which may be fittingly termed "the science of applied irrigation."

California, as regards irrigation, is still leading all other western commonwealths. In 1902 one-quarter of all the irrigated land in the United States was in this State, and it ranked



Preparing an Orange Orchard for Irrigation by the Furrow Method

progress in the reclamation of arid lands is to be symmetrical we must build up from all sides. The man who is dependent on a part of the flow of a stream for water to mature his crops should be given a chance to find out how much belongs to him. The late snow as it melts on the elevated range rightfully belongs to the irrigators of the plains, but who will distribute to each his share? These obstacles to progress emphasize the necessity of giving some attention to the legal and administrative sides of irrigation

first in the total number of irrigated farms and in the total construction cost of systems. In no other state of the Union is land so carefully cultivated, water so skillfully and economically applied, or the value of irrigated products so high, and in no other state is there so great an extent of fertile arable land for which the available water supply is so large.

Notwithstanding this creditable showing, development in irrigation has not been symmetrical. Some branches of this dominant industry are

lagging behind. All the well-directed efforts of patriotic citizens to improve upon the legal and administrative features of our systems, while they cannot be said to have wholly failed, have not borne fruit. In this respect the state is so far behind the times that the moss is beginning to show green on our outer garments. But the people are still hopeful. In fact, Californians are always hopeful, and when sufficient progress is made in other directions their attention will again be directed in earnest to the determination of rights to the use of water and the establishment of an efficient system of administration.

It is gratifying to be able to state that in all other branches of irrigation the state is making rapid progress. The United States Geological Survey is obtaining valuable data in gaging the flow of streams, mapping irrigable areas, and locating and surveying reservoir sites. The engineers of the Reclamation Service have labored assiduously for the past three years in determining the feasible projects that may be built in future by the government. Apart from the work that is being done through the various agencies of the government, the people themselves are becoming enthusiastic over the beneficial results of irrigation and the important part which irrigated agriculture is destined to play in the future prosperity of this commonwealth.

After noting this outline readers may understand more clearly the purpose of the irrigation and drainage investigations that are being carried on under the joint coöperation of the Office of Experiment Stations of the U. S. Department of Agriculture and the state of California. These investigations may be grouped under five different heads, each of which is briefly outlined in the following paragraphs.

IRRIGATION UNDER PUMPING PLANTS.

The owners of pumping plants in California are expending from one to two million dollars a year in raising water from wells for use on orchards,

vineyards, and fields. In addition to this annual expenditure a much larger sum representing many million dollars has been invested in the equipment of these plants. This branch of irrigation, although the latest to be developed, is likely to prove in time one of the most important. In parts of this state the flow in the natural streams is practically all utilized and hereafter municipalities and farming communities must depend on underground supplies. In other parts the irrigable areas are so extensive, the sources of supply so far distant and the loss by percolation so great, that pumping becomes not only a cheap means of irrigation, but a necessity on account of drainage.

The operations in this branch are confined this year to the region around Pomona, in southern California, where there are about 145 pumping plants located within a radius of ten miles of Pomona. One part of the work consists of finding out what use is being made of the water which is raised from wells and the other part has to do with the mechanical tests of typical plants. The former includes a description of the irrigation conditions within the district, a determination of the duty of water under certain plants, a description of the methods used in applying it, and some knowledge of the yield and value of irrigated crops.

The latter includes a description of each plant tested and all the data pertaining to a complete mechanical test such as the discharge of the pump, the total lift, the power developed within the cylinder of the engines, the fuel consumed in a given time, the general arrangement of parts, the efficiency, as well as the good and bad features of the entire plant. Complete tests have already been made this season of 25 plants. It is hoped that the results of this line of investigation will tend to lessen the present cost of water, not only in remedying the mechanical defects of plants, but in a more economical use of water in the orchards.



Four-inch Centrifugal Pump driven by a twenty horse-power Gasoline Engine, near San Jose. Capacity 600 gallons per minute.

LOSS OF WATER BY EVAPORATION.

During the present season evaporation records are being taken at the following places in California: Calexico, in the Imperial Valley; Pomona and Riverside, in southern California; Tulare, in the San Joaquin Valley;

Berkeley, to represent the Coast counties, and Chico, in the Sacramento Valley. Some of these stations are scantily equipped, but at other places there are water-jacketed galvanized iron tanks and apparatus for raising and weighing them, besides rain-



Another View of Same Pumping Plant

gages, thermometers, anemometers, etc.

Investigations in this line have been carried on for two years and have embraced the following experiments: To determine the rate and amount of evaporation from water surfaces such as from irrigation checks, canals, and reservoirs, and the influence exerted by such factors as temperature, wind, altitude, and humidity. In like manner an effort has been made to determine the evaporation from the surface of typical soils and to ascertain and compare the loss from this cause on soils that are irrigated in each one of the standard methods.

In an experiment which had for its objects the determination of the loss by evaporation from soils containing different amounts of moisture, the difference was so great that it was decided to take up the question of soil mulches of different depths varying from zero to 12 inches. Various crops have also been grown within tanks under field conditions to determine the actual quantity of water required by each for vigorous growth and in the same connection to ascertain, if possible, the transpiration of different plants and the relation between the amount of water evaporated from the foliage of plants and that lost by evaporation from the surface of the adjacent soil.

A little thought will convince anyone familiar with irrigation that these subjects which have never been considered by the cultivators of the old irrigated regions of Europe and Asia and which have but recently begun to attract the attention of western farmers lie at the very foundation of irrigation practice and until more accurate information is obtained concerning them the irrigator cannot be certain that he is watering his crop in the right way or at the right time.

THE IRRIGATION OF CITRUS ORCHARDS
NEAR RIVERSIDE, CAL.

The successful production of oranges represents, it is believed, the highest type of the husbandman's art.

As a corollary to this fact it may be stated that in no other part of the civilized world is there to be found more intelligent farmers than dwell amidst the orange groves of southern California. A high order of intelligence is required in order to succeed. In the first place suitable land on which oranges can be grown is high-priced, and water extremely scarce and valuable. In addition to these there is the cost of cultivation, irrigation, pruning, spraying, picking, packing, and marketing, all of which amount to a large sum per acre. The cost of production being so high there is need of skillful management and the closest kind of economy.

The main purpose of our investigations is to lessen the waste of water applied to citrus orchards and thus reduce the annual cost of the water bill. In order to accomplish this purpose it was necessary first to study in a general way the growth and root development of citrus trees, the depth and character of the soil, frequency of irrigation, quantity applied at each watering, mode of cultivation, and the like. In addition to these, a comparison is being made between the effects of shallow and deep furrows, and the rate of percolation from each. By means of borings and the taking of soil samples at different depths some knowledge is obtained of the distribution of water in the soil and the probable amount lost by evaporation from the surface. In the end, we hope to be able to give a partial answer to the irrigator's question, "what becomes of the water which is spread over my orchard during an irrigation?"

STUDIES OF METHODS OF PREPARING LAND AND APPLYING WATER.

During the past two years the different ways of preparing land to receive water and the most common methods of applying it have been studied. The results of these studies have been something of a revelation in that it has shown that this branch constitutes in many cases the big half of the

total cost of irrigation. It has been found, for example, that in the San Joaquin and Sacramento Valleys communities which have expended \$10 per acre in building dams and ditches have had to expend a like sum per acre in order to prepare their fields in such a manner as to be readily and cheaply irrigated. At least \$15,000,000 have been expended by the farmers of California in preparing the surface of their fields for irrigation. It is no exaggeration to say that the same work might have been better done for less than one-half of this immense sum if men knew how to go about it. Of necessity, every owner or occupant of an irrigated farm has had to do more or less experimenting in order to succeed, and \$100 spent in experimenting on each of the 35,000 farms soon runs up into the millions. Now the agents of the Office of Experiment Stations are fully convinced that in the reclamation of the millions of acres of fertile land which yet remain unwatered in this state much may be saved in both labor and money if farmers are given an opportunity to become familiar with the best methods and the best practice.

The results of the preliminary work done in this line in 1903 and in a part of 1904 are embodied in Bulletin 145 of the Office of Experiment Stations and since that time the work has been

taken up more in detail in particular districts of the state. The investigations now being carried on under this head are confined to the Modesto and Turlock Irrigation districts. An effort is being made to determine by actual demonstration to what extent grain can be profitably irrigated in these districts as well as the best methods to adopt in the irrigation of grain and alfalfa.

ECONOMY OF PERMANENT STRUCTURES IN THE IRRIGATION SYSTEMS OF CALIFORNIA.

The officers of irrigation enterprises have used mostly wood in building their structures in the past. In this custom they have but imitated the example set by the management of railways. But the pile and trestle bridges of railway companies are being rapidly superseded by steel and masonry, and it is believed that the time has now come when more permanent structures are needed in irrigation works.

The purpose of our study is to show by concrete examples the economy of using concrete and steel in place of wood and to compare the first cost, general efficiency and durability of such structures, as headgates, flumes, inverted syphons, drops, etc., when built (a) of wood, (b) of steel, and (c) of a combination of concrete and steel.

THE INFLUENCE OF PRIVATE TIMBER- LAND OWNERSHIP ON THE FOREST POLICY OF CALIFORNIA

BY

E. A. STERLING

Assistant Forester, U. S. Forest Service

IN CALIFORNIA the high value of water for irrigating purposes, the presence of large natural forest reserves, and the general sentiment which favors and encourages forest

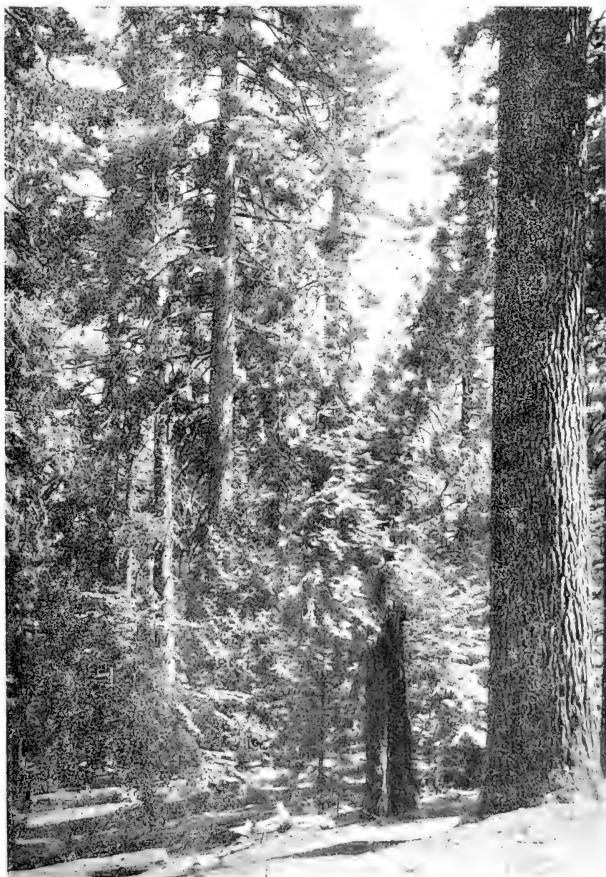
preservation, combine to give opportunity for the application there of profitable and highly effective forest methods. The influence which is most powerful in preventing the utilization

of the forest resources of that state in a manner looking toward their continued productive and protective value is that exerted by the private timberland owner—the lumberman.

Of the total forested area in California, 13,418,136 acres are within the boundaries of the National forest reserves. Since these reserves are under careful management, fires in them are prevented as far as possible,

and timber cutting restricted and regulated in order that the forest's productive capacity may not be destroyed, it would appear that Californians need not fear the denudation of their timberlands or the diminution of their supply of irrigating waters.

Yet the facts of the case are that much of the finest timber lies outside of the reserves and that the best stands on the important drainage basins



Private Timberland in the Sierra Forest Reserve

within the reserves are in the hands of individuals or corporations. Most of these private owners are not as yet inclined to apply even the fundamental principles of forestry, but cut their timber by the destructive methods which under present economic conditions give the highest returns regardless of the condition in which the cut-over land is left, or of the effect on future growth or water conservation. The results are bound to have a most potent influence on the agricultural

contribution for cooperative work with the Federal government during the past two years. They have, too, on their statute books a recently enacted forest code, which provides for the management and protection of the forests within the state.

The successful application of this forest law depends largely on the attitude lumbermen take toward it. Without forests of its own and with such large areas in the hands of the Federal government, obviously the



Private land within the San Bernardino Forest Reserve, lumbered and burned in 1903

development of the state, through the increased difficulty of regulating floods and of securing the water needed for irrigation and power.

California is with good reason considered one of the most advanced states in forestry matters. The people are progressive, appreciative of their forest resources and have not neglected opportunities to procure advice and assistance which should insure the highest use of the water and wood. This is shown by their liberal

only remaining field of action to the state is on the forest lands of the private owner. It is possible to render him cooperative assistance of the utmost value, and if it is accepted highly beneficial results will accrue to the State at large. On the other hand, if this assistance is not welcomed, and if the disposition shown by the Legislature at its last session, to oppose legislation helpful to the forest owner, grows, the private timberland owner may be the cause of changing the

whole forest policy of the State. This change will not be for the better, but will undermine a carefully-prepared policy which promises to place California to the fore of all other states in the matters of applied forest legislation.

If the lumberman is not reached, and state and Federal forestry is applied in only the National reserves and state parks, the tendency of the people will be to overlook this work and say that the expected results have not been forthcoming. The reserve administration would persist despite such a sentiment, but it would take even less than this to turn the State Legislature against forestry, and secure the repeal of the forest law. It is of the utmost importance then that every effort be made through cooperation and education, to secure the most complete utilization without destruction of the private forest lands within the state.

Demonstrations of the results bound to follow if present logging methods continue unmodified are not wanting. The American River to-day finds source in a well-forested region in the central Sierra, and maintains a full, well-regulated flow throughout the year. Practically its entire drainage basin is owned by two lumber companies; one of which is cutting at the rate of 50,000,000 board feet per year. The changes in the condition of the watersheds of the American River which these operations are rapidly bringing about cannot fail to have a most marked influence on the character of the streamflow. The flood situation in the Sacramento Valley is becoming more serious yearly, and thousands of acres of valuable wheat land are lost through inundation or gullied beyond repair. A plan costing into the millions is projected for the control of these floodwaters. The Sacramento River is fed by numerous tributaries which flow from the forested slopes of the adjacent mountains. These timberlands are under rapid exploitation, and the retaining forest

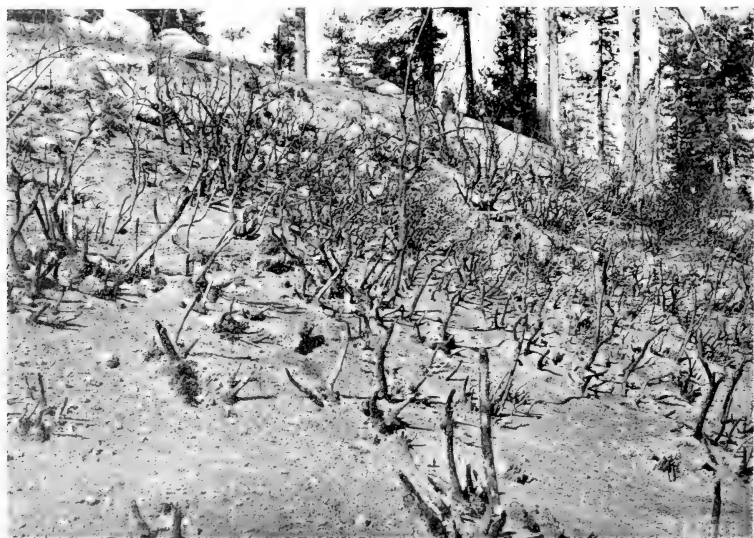
cover is removed from thousands of acres annually. This means that the speed of the runoff and the amount of debris and silt carried by the streams will increase indefinitely. Consequently, dredging the main river, straightening the channel, and constructing dikes in the valley, will not touch the root of the evil; in order to be of permanent value all such work must look to an increasing volume of floodwater in keeping with the disturbance of the watershed cover by logging operations.

Another example is found in the San Bernardino region in southern California, where every inch of water is carefully utilized and future agricultural expansion is wholly dependent on the development of an additional water supply. The entire mountain range adjacent to the rich fruit lands of the valley is within the San Bernardino Forest Reserve. Most of this reserve, however, is covered with chaparral, and the small stands of timber—on the only true forest land in the region—is owned by lumbermen, who are cutting it rapidly. Fortunately, most of this timber occurs on the drainage basins of streams which flow into the Mohave Desert and are lost; yet the reduction of this land to chaparral or barrenness will have its effect on the water supply, and especially on a new irrigating reservoir which is under construction.

The general effects of the present methods of logging private land in California are several. The tendency is everywhere strong for cut-over land to revert to chaparral, and repeated fires continually render this condition worse by killing the reproduction and ultimately the seed-trees. Through its sprouting powers the chaparral is thus extended over large areas which cannot be reclaimed by natural processes as long as existing conditions prevail. In California, as elsewhere, fire is the greatest hindrance to applied forestry. The floor of the virgin forest burns over readily, but it is not until the land is logged that the fires attain their

maximum violence. Private timberland owners assume a hopeless attitude toward the fire question, rarely making systematic effort to protect even their own property. The effect of the repeated fires in reducing the forest's productive capacity and destroying its water-conserving powers does not need elucidation here. The annual loss to the state from this source deserves the most serious thought. The water question is mightily influenced

those elsewhere, or that there is here the slightest intention of taking sides with the sentimental forest enthusiast who brands all lumbermen as vandals. Since California is on the upward wave of forestry progress it is unwise, however, to overlook the influence which the private owner exerts. His methods of management are natural and logical. He has to deal with a purely business proposition, which will continue as such. The hope of



Forest Land which has reverted to Chaparral, and the Chaparral in turn burned to an extent which destroys its value as a watershed cover

by the management of private timberlands, through the effect which the fires and chaparral which follow logging have on the water-retaining capacity of forested drainage basins. Whether or not the general climatic conditions are changed is an unsettled question, on which scientists usually take the negative and laymen the affirmative side.

It must not be inferred that private owners of timberland in California are any different or any worse than

forestry is that it, too, is based on business principles which, with the changing economic conditions, can be successfully applied to lumbering operations. The application of the more fundamental principles of practical forestry on private timberlands in California will ward off the menace to the water, agricultural, and timber interests which threatens if present methods are continued.

Compared with other regions and other states the attitude of the Cali-

fornia lumbermen toward forestry is excellent. Many of the operators are from the lumber-producing districts of the South and East, and have seen the disastrous results of non-conservative logging. Moreover, they realize that unexploited timberlands are no longer easily obtainable and that their present holdings must be managed with a view to future continuous production if their business is to be perpetuated. The strong natural tendency of the California forests to reproduce themselves and the exceedingly high value of the several commercial species, strengthen the possibilities of conservative management, and slightly modified logging methods combined with reasonable fire protection will change the whole aspect of affairs.

Cooperation which will give the private timberland owners the assistance of State and Federal foresters is the need of the hour. This assistance in matters of fire protection and of management has already been furnished in several cases by the Bureau of Forestry, and the tendency is toward expansion in this direction. After the organization of the state forest system, active cooperation may be expected from the technical forest officers of the state. On the whole, the outlook is promising, and although the most serious results would follow a continuation of existing methods, there is almost absolute certainty that

within the next decade all will be changed for the better. The systems of logging and of fire protection applied by the National government on the forest reserves will demonstrate the possibilities for profit in conservative forest management; while the growing scarcity and increased value of both major and minor forest products will make possible the better use of private timberlands, and the reforms introduced will insure a decided economic advantage to the owners of such conservatively-managed land.

This question of private timberland ownership and management in California is extremely important and should receive careful local study in each of its many phases. No attempt has been made here to more than briefly outline the more striking points, and indicate in a very general way the influence which the lumbermen exert on the forest policy of the state. To summarize, it may be said that if present methods remain unmodified the forest and water resources, which are two of California's greatest assets, will suffer irreparable injury, and the general policy which aims to secure the highest use of these resources will lose its force. On the other hand, if the practicability of forestry on private timberlands is fully demonstrated, there is no state where there is better opportunity for the development of an effective forest system, or where a greater variety of important commercial interests will be benefitted.



STUDIES OF CALIFORNIA GROUND WATERS

BY

W. C. MENDENHALL

Geologist, U. S. Geological Survey

THE U. S. Geological Survey has been engaged for nearly two years in a study of the underground water situation in Southern California. The work began in the region known as the Valley of Southern California. This is the irregular lowland south of the San Gabriel and San Bernardino mountains, in which the cities of Los Angeles, Pasadena, Pomona, Ontario, Redlands, Riverside, and Santa Ana are situated. Throughout this delightful area, water is worth more than in any other agricultural district in the Western Hemisphere, because of its limited quantity and the high values of the lands to which it can be applied. Two thousand dollars per miner's inch, a flow equivalent to about 13,000 gallons per day, is not regarded as an excessive valuation in parts of this area, and some of the citrus lands are bearing water charges at rates of from \$10 to \$30 per acre per year. Such taxes are possible only where the returns from the crops raised reach high figures, as they do in the best of the California citrus lands.

Irrigating waters are pumped to heights of 250 feet in a few cases in Southern California, and are in successful use despite this great lift. At one point in the San Joaquin Valley water is pumped to an elevation of 600 feet above its source and used in citrus irrigation. This is probably the highest lift in the United States of waters for agricultural uses. The fact that it is found to be feasible from the financial standpoint to install and operate the expensive machinery required for this purpose, is a sufficient commentary on the productiveness of the lands and the value of the crops which they yield.

In communities where such practices prevail it is needless to say that the value of water is fully appreciated and that the citizens are heartily interested in all studies which tend to throw definite light on the quantity and availability of the supplies. The best engineering talent has been busy for two decades, devising means whereby waste of water may be prevented, new sources utilized or old sources conserved. Reservoirs are being covered, unlined ditches cemented, open ditches converted into pipe lines, irrigation practice improved so that evaporation from the soil surface may be minimized, and temporary flood water dams built, to aid in recharging the subterranean basins. The influence of forests is realized and local chambers of commerce are making appropriations to aid in reforesting denuded slopes in the important drainage areas. At the same time the courts are restudying with great care all the principles upon which water rights are based. As a result, epoch-making decisions have been rendered whose object is to preserve and protect vested rights in underground waters, rights which seemed in jeopardy under the attempts to apply old riparian principles under conditions which were not anticipated in the place and at the time when they were enunciated.

It is in this spirit of care and thoroughness and exceptional intelligence, that the Southern California communities are grappling with their problems of water supply. It is not surprising therefore, that they have accomplished much with the rather limited quantity which is available for their use.

The minimum summer flow in the Southern California streams, and it is this minimum which controls irrigated acreage, is in round numbers 250 second feet. With high economy this would be sufficient to irrigate 80,000 or 90,000 acres. Actually, 225,000 acres are under irrigation. This result has been accomplished by the utilization of underground waters. These subterranean sources now furnish supplies for twice as much acreage as the surface waters. They have certain definite advantages over the surface supplies, in that their quantity is comparatively uniform throughout the year; while surface streams are lowest when the demand for water is greatest.

These waters which have become so important in Southern California, during the last decade especially are the object of especial investigations now under way. Their distribution has been pretty well determined by the developments already carried out, but their quantity and the limits of safe use are not known. A series of observations is now being made whose object is to determine whether these limits have been reached in any particular community. These measurements have been conducted for nearly a year and preliminary deductions may soon be reached from them. Meanwhile, reports are being issued in which the results of studies of underground conditions are given, artesian outlines and changes in artesian areas are mapped, depths to ground waters are shown, the results of determinations of alkalinity are given, and lists of wells, with their costs and yields, are tabulated. All of these accompany texts in which the sources of the ground waters are discussed and their quantitative dependence upon rainfall on the one hand and development on the other, are brought out. It is hoped that where a tendency exists to develop underground waters beyond the limits of safety, that tendency may be checked by a clear statement of the conditions.

In certain portions of the desert areas of Eastern and Southern California, underground waters are known to occur in some quantity. One of the most important of these areas is that centering about Indio, Coachella and Walters, in the northwestern end of the Colorado desert. Fifty years ago, when this desert, 287 feet below sea-level at its lowest point, was one of the most dreaded spots in the arid west, Prof. W. P. Blake predicted that artesian waters would be found beneath its surface. In 1888 the Southern Pacific Company secured a small artesian flow at Indio, and the prediction made 35 years before was fulfilled. Since 1900, when a method for sinking deep wells rapidly and cheaply was applied, developments in this desert valley have been rapid. Its unique climatic conditions, which favor prolific growth and the early maturity of many crops when water can be applied to the soil, have given it especial agricultural advantages which are being utilized by its pioneer settlers.

Its growth depends entirely upon the underground waters which are secured from about 350 wells. The majority of these are artesian, and with the waters which they yield 4,000 acres have already been brought under cultivation. Cantiloupes, watermelons, sweet potatoes, early table grapes and hay and grain crops are successfully grown, and the finer qualities of dates, and citrus fruits are being tried. The ground waters in this region, upon which its agricultural existence and continued growth depend, have been carefully studied by the Survey and a report upon them is now in course of preparation.

Down through the center of California stretches the great Valley of the Sacramento and San Joaquin Rivers. It is 400 miles long and from 10 to 50 in width, an empire in itself. From south to north and from east to west it presents a wide range in humidity from a rainfall of 8 inches annually to one of 40 inches. The variety of prob-

advance in importance. Although the protection of the source of water supply is not to be disregarded, the natural conditions are more favorable and the extreme vigilance necessary in the southern reserves can here be relaxed somewhat. Consequently, the mature timber can be more freely disposed of to the mining and other interests needing it, and the forage crop can be more closely harvested without danger to the reserves. Liberal allowance is made for grazing cattle and horses, and on the eastern slope of the Stanislaus Reserve, sheep grazing is allowed. The question of allowing sheep grazing on certain portions of the Sierra reserve, which are reported as best adapted for use by that class of stock, will be investigated during the year and all interests carefully considered before final action is taken. Trails have been established through both the Sierra and Stanislaus Reserves for driving bands of sheep across in moving between summer and winter pastures. Every effort will be made to encourage the stockman in a proper use of the forage and special inducements will be offered to those who willingly cooperate with the government in the protection and improvement of the reserves.

One of the greatest needs for the future development of the mining interests of the state, is cheaper power. This can best be secured by use of the water power furnished by the mountain streams in generating electrical power. The regular flow of water necessary for the success of this enterprise is best insured by preservation of the forest conditions on the head waters of the streams. The success of mining also depends largely upon the forest, because the miner must have an ample supply of timber for use in working his mine, he therefore has a vital interest in the preservation of the forest, and should be one of the strongest supporters of the reserves. In the future management of the reserves an effort will be made to meet the local needs and make improve-

ments in the methods of transacting business, which should result in great benefit to the mining industry.

Since January 1, 1905, six new forest reserves have been created in the northern part of the state, as follows: The Modoc, Warner Mountains, Plumas, Trinity, Klamath, and Lassen Peak. These reserves were all examined carefully prior to their creation and the boundaries have been drawn so as to include only lands suited to forest reserve purposes.

In the Modoc and Warner Mountains Reserves, located in the extreme northeastern corner of the state, the principal object in their creation was the protection of the water supply needed to insure the continued prosperity of the adjoining settlements. Stock-raising is one of the most important industries in this section and liberal allowances have been made for grazing cattle, horses, and sheep. It will be the policy to allow a full utilization of the forage products of these reserves and to gradually adjust the number of stock allowed to the actual grazing capacity of the lands. With range protection a better grade of stock will be raised and in the long run forest reserve regulations will result in insuring a permanent improvement in range conditions, and increased prosperity to the resident stockmen.

The Plumas, Trinity, Klamath, and Lassen Peak reserves are all chiefly valuable for their extensive forest, and excellent stand of merchantable timber. In the Plumas Reserve, of its 579,520 acres, it is estimated that 80 per cent. is forest land with a stand of accessible merchantable timber averaging 7,450 feet board measure per acre. In addition to this, there is almost an equal amount of timber which at present is inaccessible, but will become available in the future when the demand is sufficient to warrant the building of roads for its transportation.

In the Trinity Reserve it is estimated that sixty-five per cent. of the

area has a stand of merchantable timber averaging from 5,000 to 50,000 feet per acre. At present this timber is remote from transportation and the only demand upon it is for the local supply of the mines and settlements in its vicinity.

The Klamath and Lassen Peak reserves both contain a very large proportion of forest land, but the stand of merchantable timber is lighter, and does not generally average more than 5,000 to 6,000 feet per acre, although there are limited areas which will produce over 50,000 feet per acre.

Only a very small proportion of either of these reserves has been cut over, and their protection and conservative use, therefore, means an assured annual crop of timber to supply the needs of the state in the development of its mining, agricultural, and commercial interests.

The live stock interests are of considerable importance on these four last mentioned reserves, and the proper utilization of the forage will be one of the important questions in their management. Owing to the fact that the season is now well advanced, the grazing regulations will not be enforced in

the Trinity, Klamath, and Lassen Peak Reserves this year, but all stock which have been grazed regularly therein will be allowed to remain. Every effort will be made to assist the stockman in a satisfactory division of the range and in a better and more economic use of the forage.

The business men of the state have been aroused to the importance of protecting the forests, and public sentiment is now very strong in support of a conservative forest policy. This has been substantially demonstrated by the action of the state legislature, first in the passage of an act providing for a cooperative forest investigation by the Bureau of Forestry, and finally by the passage of a strong state forest law. It is the duty of the government to assist the people in bringing about the best possible use of all forest resources. The people, on the other hand, must continue to give their support and assistance in carrying out the work which has been so well begun, and must cooperate with the state and national forest officers in the enforcement of such regulations as are necessary to insure the best use and permanent value of the forests.

HOW THE COMMERCIAL ORGANIZATIONS OF CALIFORNIA COOPERATE WITH THE MOVEMENT FOR GOVERNMENT RECLAMATION.

BY

HAMILTON WRIGHT*

CALIFORNIA is vitally interested in the subject of irrigation. Water is the life blood of the state's agricultural development. The value of products of irrigated land in California is more than double that of any other state, though the actual irrigated area is estimated to be less than

that of the state of Colorado. In certain sections of California, notably the southern part of the state, water is more valuable than probably anywhere else in the world. For these reasons the people of the whole state are eager to take advantage of the National Reclamation Act, and it is of interest to

* Mr. Wright accompanied the Congressional Irrigation Committees on a large part of their recent western tour.

note that there is such thorough organization and unanimity of sentiment in California that they are enabled to avail themselves of its privileges.

During the lifetime of the state a

number of these properties were originally Mexican grants, whose owners were, apparently, unwilling to subdivide for the benefit of intending settlers. This condition, if not remedied, would disqualify some of the most



MR. RUFUS P. JENNINGS

Executive Officer of the California Promotion Committee, and President of the River Improvement and Drainage Association of California

unique agricultural condition has prevailed in California. Much of the best agricultural land is held in huge ranches, some of them embracing in the neighborhood of 100,000 acres in single holdings. By far the larger

promising agricultural sections of California from taking advantage of the provisions of the Reclamation Act. As is generally known, the purpose of the government in constructing great storage and diversion dams and in build-

ing canals, laterals and headgates under the Reclamation Act, is to provide homes for the homeseekers. Consequently the farm unit is limited to 160 acres and in some instances to less than this amount according to the character of the land. Although the government contemplates irrigation projects for the benefit of homesteaders, and endeavors, as far as possible, to undertake works with the view of bringing water to available government lands, yet, in the event that individuals are willing to sub-divide their lands and to sign a contract which will prevent land speculation, anticipating increased values through irrigation, irrigation works will be undertaken under the Reclamation Act even where the land is in private ownership. This is the case in the Salt River Valley, Arizona, where a dam capable of impounding enough water to irrigate 200,000 acres of land will be constructed. The settlers in that section have gone ahead and accomplished marvels. The development has exceeded the water supply, but they are willing to sub-divide: the government is coming to their aid.

The commercial organizations of California will make possible the work of the government under the Reclamation Act by effectually conducting the campaign for the sub-division of great tracts where irrigation works are under consideration. There are in California 152 Chambers of Commerce and other quasi-public improvement organizations of like character. They all work in harmony through the California Promotion Committee, the state central organization, which is the clearing house, as one might say, for the expression of united public sentiment for progress. The executive officer of the California Promotion Committee is Mr. Rufus P. Jennings, a prominent merchant of San Francisco, who has established business-like principles in the work of building up the state. Mr. Jennings is a constant, optimistic and cheerful worker for the state and the whole west. He has so

systematized promotion effort in California as to make the sentiment of the commercial bodies of the state an irresistible force for progress. Already the California Promotion Committee has heard from more than 70 owners of huge tracts of land that they will sub-divide. Some of these properties are so vast that it would take a man half a day to ride across one of them, and their sub-divisions oftentimes occasions a considerable sacrifice on the part of the owners.

There are more commercial organizations in California than in any other state. They expend in their regular routine work all the way from \$1,000 to \$30,000 a year each. Those who support them obtain no direct benefits, but share results with the rest of the community. The organizations invite confidence and command respect. They have nothing to buy and nothing to sell. They crystallize public sentiment. Primarily their function is to advertise and induce immigration. The larger part of this work is performed through the California Promotion Committee, the local organizations devoting themselves more particularly to making ready for the settler and of caring for him when he arrives in California. In this immigration work the commercial bodies can be of the greatest assistance to the government which desires a progressive class of agriculturists to take up land under the reclamation projects. If the settlers succeed, and everyone conversant with conditions in the areas to be reclaimed is convinced that most of them will succeed, they will be enabled to return to the government the sum expended on the project in their territory as contemplated in the Reclamation Act. In the great Truckee-Carson project recently completed the government has finished the work (or at least enough is completed for demonstration), and it remains for the intelligent and industrious settler to do his part. When it is known that in a little over two years the California Promotion Committee has sent out

over 2,000,000 pieces of literature; had a correspondence of over 225,000 letters; published hundreds of articles in the press and sent out lecturers through the farming districts of the east, it is apparent how organizations of this kind can assist the government in selecting a desirable class of settlers.

A project of great importance to California is the reclamation of approximately 2,000,000 acres of land in the great Sacramento Valley. The climate conditions are far less extreme than those in the desert regions. Here the land is in huge holdings being mainly devoted to grain or grazing, but wherever irrigation has been practiced the results are remarkable. It is the largest and most comprehensive irrigation project which the government has under consideration. Water will be conserved by means of seven huge reservoirs and distributed over the valley, which is 250 miles long and from 20 to 60 miles in breadth. Here the problems of irrigation, reclamation, navigation and drainage are all closely connected; for, with the storage of waters, the crests of the spring floods which have for years broken the levees on the lower reaches of the Sacramento River and destroyed millions of dollars worth of property will be controlled. A movement fostered by the River Improvement and Drainage Association of California, is now under way to improve the navigation of the Sacramento River and reclaim 1,000,000 acres of swamp lands. The work calls for an expenditure of \$24,000,000. Twice as much land will be reclaimed as in the case of Zuyder Zee project in Holland at less than one-fourth the cost. The recommendation of a commission of engineers consisting of Major H. B. Richardson, Major H. M. Chittenden and Mr. T. G. Dalney, calls for a uniform system of levees which shall confine the river and cause it to scour and, consequently, deepen its channel. The extension of the levees with connecting dikes in the overflowed lands will enable these

lands to be reclaimed. The cost of this work will be born equally by the state of California, the Federal government, and the land owners. The improvement of the Sacramento River and the reclamation of the swamp lands is of course in no way connected with the irrigation project for the Sacramento Valley under the Reclamation Act. The government's part in the river improvement will be carried on by the War Department while the irrigation project comes, of course, under the Department of the Interior. But in both projects the commercial organizations are lending great aid to the movement. The whole state of California is behind the river improvement project, and without the united sentiment which was brought out at a meeting of representatives of all commercial organizations of the state, the united work would never have been undertaken.

The United States Senate and House Committee on Irrigation recently completed an extensive trip through the west. The journey was made for the purpose of visiting locations where irrigation works have been begun or are planned under the Reclamation Act, and incidentally of gathering first-hand information relative to irrigation in general. The journey was a distinctly strenuous one and the members of the visiting committees put in long and earnest hours (at their own expense). Though the visit was not official, much will result, as it was an educational campaign on irrigation, not only for the members of the Senate and House Committees, but for the residents of the regions visited.

The intense and general interest in the subject of national irrigation was most enthusiastically demonstrated everywhere. The citizens turned out in great numbers to greet the visiting legislators. The California itinerary lasted eight days, beginning at Yuma on the morning of June 8 and terminating at Sacramento on the night of June 16, when the party left for Reno

to attend the exercises on the following day at the opening of the Truckee-Carson irrigation project, the first to be completed under the Reclamation Act.

This article would be incomplete without mention of Mr. J. B. Lippincott, the distinguished and unusually energetic engineer of the U. S. Geological Survey in California, and his assistants. Mr. Lippincott's work has

prepared the way for government projects far in advance of what his office would call for. He is eager for California and the west. He possesses the confidence of all the people and invites their cooperation.

The members of the Congressional Committees were enabled to make a most comprehensive itinerary owing to the fact that the Southern Pacific Company placed a special train at their disposal.

THE SIERRA CLUB

An Interesting and Useful Organization of Mountaineers and Nature Lovers

BY

WILLIAM E. COLBY

Secretary, The Sierra Club.

"CLIMB the mountains and get their good tidings. Let Nature's peace flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop off like Autumn leaves."

This is the gospel preached by John Muir for these many years. It has been taken up by the Sierra Club, which was organized in California in 1892 by a number of enthusiastic mountaineers and nature lovers whose thoughts and ideas had become crystallized in the successful effort to establish the Yosemite National Park. John Muir was chosen as their leader and has presided over their counsels ever since. The university of California and Stanford University, through their faculties and alumni, have furnished a large part of the strength and vitality of the club. The corporate purposes are, "To explore, enjoy, and render accessible the mountain regions of the Pacific Coast; to publish authentic information concerning them; to enlist the support and cooperation of the people and the government in preserving the forests and other natural features of the Sierra Nevada

Mountains." Its members have made pioneer ascents of almost inaccessible peaks, have explored and mapped large areas of the High Sierra, and have called the attention of the public to the beauty and grandeur of the mountains of California. But its most important work has been in aiding in the establishment of the forest reserves.

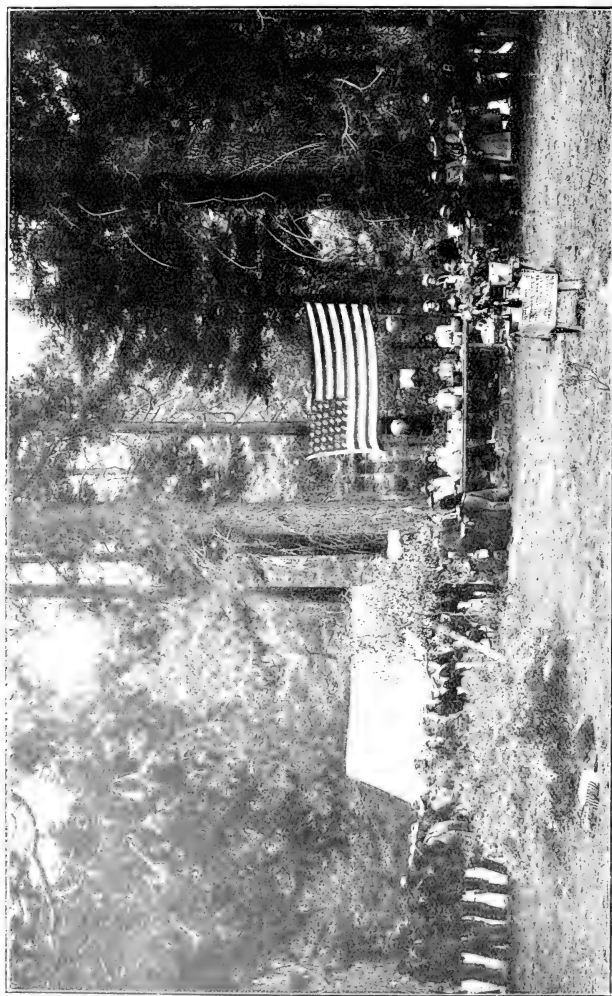
President Roosevelt, in his address at Stanford University in 1903, spoke of the Club's work as follows: "California has for many years, I am happy to say, taken a more sensible, a more intelligent interest in forest preservation than any other state. It early appointed a Forest Commission; later on some of the functions of that commission were replaced by the Sierra Club, a club which has done much on the Pacific Coast to perpetuate the spirit of the explorer and pioneer."

Every movement which has for its object the preservation of our forests or our natural scenery finds the club an active champion. It has been cooperating with other organizations which have allied interests and particularly with the various branches of the government service which have

done so much of late years to promote the welfare of the West. Too great praise cannot be given the departments which are handling the tremendous problems involved in forestry and irrigation. The work which has been accomplished in the past few years is almost beyond belief and the plans for

the future are only more stupendous.

While the Sierra Club is most heartily and actively in favor of this utilitarian side of the forest and water questions yet we also feel that the aesthetic and ideal features of our mountain scenery require the most jealous guardianship. This is es-



With the Sierra Club in Kings River Canyon

Photo. by Prof. J. N. LeConte

pecially true right now when commercialism is so aggressive. If not carefully watched, power companies would drain our waterfalls and lumber companies fell every giant sequoia that has managed to escape their ravages in the past. As David Starr Jordan, a director of the club for many years, expresses it: "The duty of the Sierra Club, as I understand, is to stand between Californian scenery and California greed."

Every since the establishment of the Yosemite National Park, John Muir has been working to have the Yosemite Valley, which was a small grant of a few square miles under state control and in the very heart of the national park, made a part of that park. The logic of the proposed change, which would mean merely a relinquishment of the trust by the state; which would terminate the divided jurisdiction, and which would place the Valley under Federal control, where it would be far better cared for and have greater appropriation for its maintenance as well as the undivided attention of expert engineers and officials—was evident to almost every one who gave the matter a moment's thought. But like all other matters of public concern where there are no private interests to be benefited by the change, a great deal of inertia had to be overcome. The club was pleased to note in the July, 1904, number of *FORESTRY AND IRRIGATION*, an article by President Roosevelt where he stated that "As to the Yosemite Valley, if the people of California desire it, as many of them certainly do, it also should be taken by the national government to be kept as a national park, just as the surrounding country, including some of the groves of giant trees, is now kept." And in his annual message to Congress shortly after, he repeated this sentiment.

The Sierra Club had long been gathering material for this campaign, and, reassured by this expression of opinion by the President and by the Secretary of the Interior and other Federal officials, it printed and distributed information on the subject and

interested the leading men of the state in the movement. The proposed transfer was bitterly fought by a few on the alleged ground of state pride, but the better element in the Legislature prevailed and passed an Act re-ceding the Valley to the Federal government. The sentiment of the people was overwhelmingly in favor of recession, as was evidenced by the fact that over one hundred newspapers in the state favored it, while three were opposed. Congress, which was just about to adjourn, appropriated \$20,000 for the improvement of the Valley, but, owing to certain technicalities, it is claimed that further Congressional action is necessary before the Valley can be formally accepted. If this be true, it is sincerely to be hoped that it may be done without delay at the next session, in order that this greatest of all our scenic wonders may be properly cared for and rendered easy of access.

The club has recently erected a beautiful memorial lodge in Yosemite Valley in honor of the late Professor Joseph Le Conte who was a charter member and deeply interested in all that pertains to the mountains, and their forests and streams. A library is kept there for the visiting public and information as to the trails and points of interest in the vicinity freely given to any inquirer.

The club, in its endeavor to educate the people to a complete realization of the necessity of preserving our forests and scenic features, has, for several years past, conducted annual outings into the mountains. Even remote and inaccessible points of interest in the Sierra have been visited by these large parties and many of our highest peaks climbed. In 1903 during the Kern River outing, 140 persons reached the summit of Mt. Whitney, an elevation of 14,522 feet. Not one-tenth of that number would ever have been able to make this climb without the aid the club gives in making rough mountain trips easy and pleasant. We are commencing to appreciate the truth of Stevenson's words, "Though we should be grateful for good houses, yet, after all, what house is there like God's out-of-doors?"

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DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., August 12, 1905. Sealed proposals will be received at the office of the engineer, United States Reclamation Service, Billings, Mont., until 10 o'clock a. m., September 5, 1905, for furnishing 7,000 barrels, more or less, of Portland cement, f. o. b. cars at works of the bidder. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or to Robert S. Stockton, Engineer, Huntley, Mont. **THOS. RYAN, Acting Secretary.**

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., August 22, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Roswell, N. M., until 2 o'clock p. m., October 17, 1905, for the construction and completion of earth embankments, involving about 200,000 cubic yards of earthwork and 150,000 cubic yards of overhaul, at a point about 12 miles southwest of Roswell, New Mexico. Plans, specifications and forms of proposal may be obtained by application to the Chief Engineer of the Reclamation Service, Washington, D. C., or to W. M. Reed, Roswell, New Mexico. **THOS. RYAN, Acting Secretary.**

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The objects of the Association, as set forth in its Constitution, are as follows:

1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.

2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.

3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.

5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.

6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, July 7, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Billings, Mont., until 2 o'clock p. m., September 5, 1905, for the construction of the Shoshone dam, spillway, outlet and road tunnels, requiring about 69,000 cubic yards of concrete masonry and about 75,000 cubic yards of excavation, located eight miles west of Cody, Wyoming. Plans, specifications and proposal blanks may be obtained from the Chief Engineer of the Reclamation Service, Washington, D. C., or from Jeremiah Ahern, Engineer, Cody, Wyoming. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, July 7, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Billings, Mont., until 2 o'clock p. m., September 6, 1905, for the construction of a tunnel approximately 18,000 feet long, and auxiliary works, including about 28,000 cubic yards of excavation in open cut, all located ten miles east of Cody, Wyoming. Plans, specifications and proposal blanks may be obtained from the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., or from Jeremiah Ahern, Engineer, Cody, Wyoming. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., July 3, 1905. Sealed proposals will be received at the office of the Engineer, U. S. Reclamation Service, Montrose, Colorado, until 10 o'clock a. m., August 28, 1905, for the construction of about 8 miles of main distributing canal, involving the excavation of 52,000 cubic yards of material and the placing of 20,000 cubic yards of concrete masonry for the conveyance and part distribution of 1,300 cubic feet of water per second from the mouth of the Gunnison Tunnel, near Cedar Creek, to a point on the Uncompaghe River 9 miles south of Montrose, Colo. Full information may be obtained from the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., from the Supervising Engineer of the Reclamation Service, Chamber of Commerce Building, Denver, Colo., or from the Engineer of the Reclamation Service, Montrose, Colo. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., August 2, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Montrose, Colo., until 3 o'clock p. m., September 26, 1905, for the completion of the Gunnison Tunnel, involving 27,500 linear feet, more or less, of tunnel, the same being a portion of a system for the diversion of about 1,300 cubic feet of water per second from Gunnison River to the Uncompaghe Valley, Colo. Specifications, form of proposal, and plans may be obtained from the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., or from the Engineer of the Reclamation Service, Montrose, Colo.

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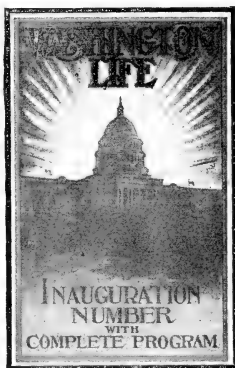


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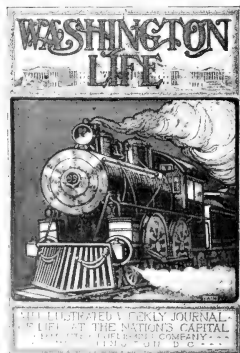
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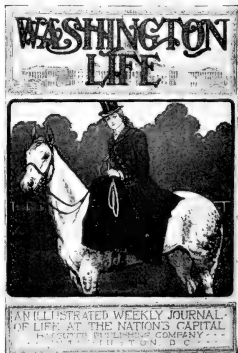


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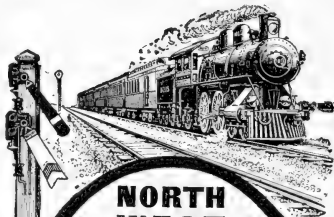
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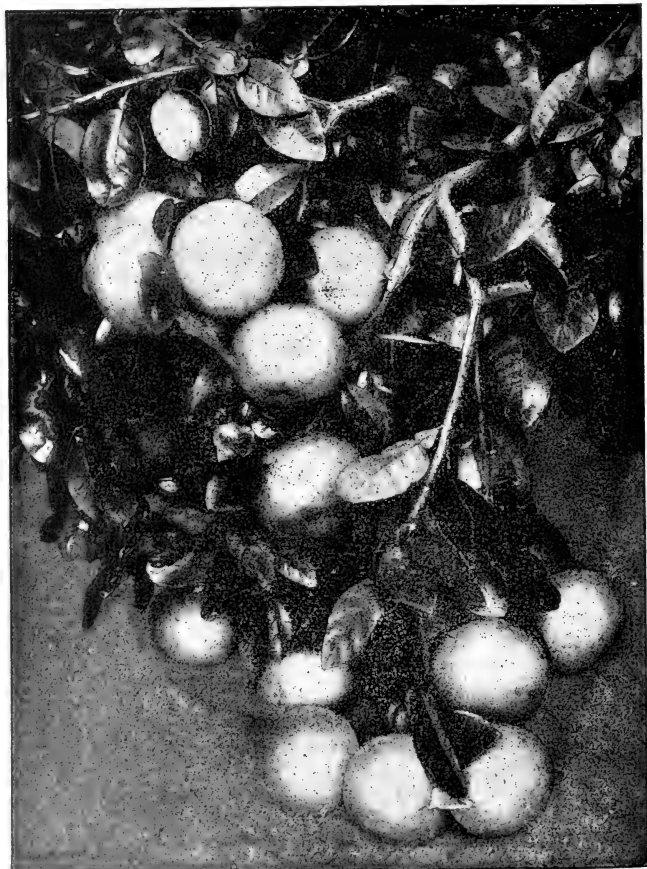
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Forestry and Irrigation

H. M. SUTER, Editor

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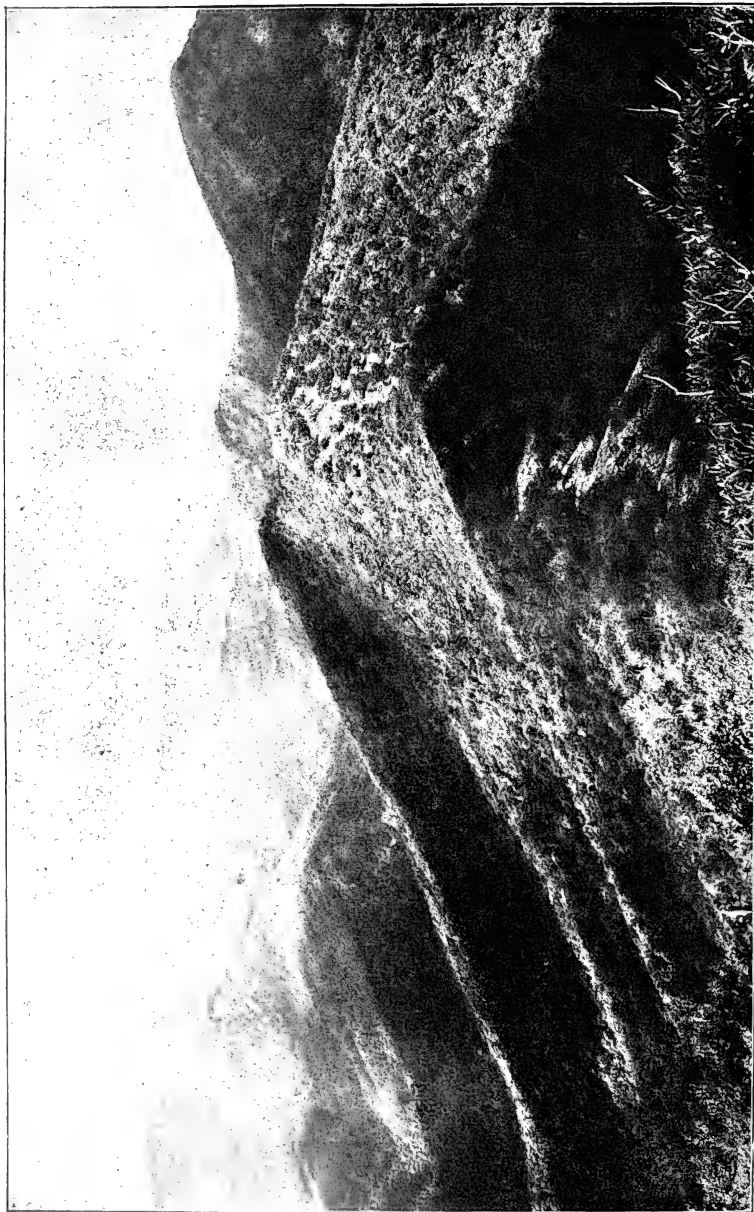
JOHN E. SHERIDAN

Potato Knob,

Mount Gibbs
(6,684 feet.)

Mount Mitchell (6,711 feet).

Pinnacle.



Panorama of the Blue Ridge, Mount Mitchell, and Southern end of the Black Mountains, the center of the proposed Southern Appalachian Forest Reserve.

Forestry and Irrigation.

VOL. XI.

SEPTEMBER, 1905.

No. 9

NEWS AND NOTES

Much Needed Forest Reserves Every reader of FORESTRY AND IRRIGATION is earnestly requested to

weigh well the reasons advanced in this number for the establishment of national forest reserves in the Southern Appalachian Mountains and the White Mountains of New Hampshire. It remains for the thoughtful and patriotic citizens of the country to work up a sentiment so strong for these reserves that Congress will be compelled to take early and favorable action in the matter. Tremendous business interests in the regions themselves are vitally concerned, the agricultural and manufacturing industries of wide surrounding country are no less seriously affected, consequently the movement for these two forest reserves becomes one that affects our general prosperity.

The American Forestry Association, the Society for the Protection of New Hampshire Forests, and the Massachusetts Forestry Association have entered upon an active campaign to secure the early passage by Congress of bills, creating the Southern Appalachian and White Mountain Forest Reserves. In this work these organizations deserve the hearty support of every person desirous of preserving and utilizing the resources of two rare regions whose welfare affect the whole country. A careful reading of the articles in this number, it is felt, will enlist the co-operation of persons who are not already familiar with the situation.

Progress in Wyoming

The State of Wyoming is to be congratulated on the prospects of development under the Reclamation law,

as the work of the various engineering parties proceeds.

The Pathfinder tunnel was completed on August 15, the contract for the construction of the Pathfinder dam was let during the month and work promptly begun. Recently the Secretary of the Interior awarded two important contracts in connection with the Shoshone project: The Shoshone dam to Prendergast & Clarkson, of Chicago, Ill., for \$515,730., and the Corbet tunnel to Chas. Spear, of Billings, Mont., for \$594,325.

The dimensions of the Shoshone dam are well known. The Corbett tunnel will be about 18,000 feet long and will be used to divert about 1,000 cubic feet of water per second from the river for irrigating lands in the vicinity of Garland and Frannie, Wyoming.

Pumping Projects in North Dakota

It is believed by the engineers of the Reclamation Service in charge of the work that so far as the engineering features and the people are concerned, the Williston, Nesson, and Buford-Trenton pumping projects in North Dakota will be ready for construction next spring.

During the latter part of August, 1904, a party of engineers arrived in North Dakota for the purpose of making a reconnaissance of the state to locate feasible pumping projects. A hasty examination of the territory was first made, the report of Prof. F. A. Wilder, of the North Dakota Geological Survey, and the maps of the Missouri River Commission studied, and field work was commenced. Chief Engineer, F. H. Newell, directed that

preliminary surveys be pushed to completion as soon as practicable in order that land owners whose properties would come under the works might have a clear understanding of the plans of the Reclamation Service and a full knowledge of the cost of the water rights.

The banks of the Missouri River between Fort Buford and Bismarck, a distance of 300 miles, have been carefully investigated, and it is believed to be feasible to lift the water of the river to low flats by pumping. Extremely favorable features are found in the abundance of water and in the cheap and plentiful supply of fuel.

The Buford-Trenton project as planned will cover approximately 18,700 acres; the Williston project, 39,000, and the Nesson project 28,600 acres. A board of consulting engineers will convene at Williston, North Dakota, on September 18th to consider designs for these systems.

**Reclamation
Contracts
Awarded**

Proposals for the construction of the Pathfinder dam, North Platte project, advertisements for which have twice been issued, have been opened at Denver, Colorado, and the lowest bidder was found to be N. S. Sherman, Oklahoma City, Oklahoma. The amount of Mr. Sherman's bid was \$459,260.

The Secretary of the Interior has executed the contract and approved the bond of E. A. Hess, of Lyons, Iowa, for the construction of a telephone system in connection with the Fort Buford reclamation project, Montana and North Dakota. This system consists of four telephone stations and about seventy miles of pole line, beginning opposite Glendive, Montana, on the west side of Yellowstone River, extending northward down Yellowstone Valley, generally following the country road, and ending near the junction of the Yellowstone and Missouri Rivers at a point nearly opposite Buford, North Dakota, on the Great Northern Railroad. Five bids

were received, of which that of Mr. Hess—\$15,939.45—was the lowest.

The Secretary of the Interior has also executed a contract with the Widell-Finley Company, of Mankato, Minn., for the construction of seven and a half miles of main canal, Fort Buford project. Seven bids were received of which that of the Widell-Finley Company—\$163,367.50—was the lowest.

The Secretary of the Interior has executed the contract and approved the bond of Monarch & Porter, of Des Moines, Iowa, for the construction of schedules 3 and 4, Minidoka project, Idaho, which consist of 63.5 miles of laterals and branches. The bid of the successful contractors was for \$194,826.75.

A contract for the construction and completion of the Pathfinder dam and auxiliary works, North Platte project, Wyoming, has been awarded by the Secretary of the Interior to the Geddis & Seerie Stone Company, of Denver, Colorado. The amount of the company's bid was \$482,000.

According to the terms under which the bid was made work must begin within thirty days after the signing of the contract, and the entire work shall be completed on or before Nov. 1, 1908.

The Secretary of the Interior has awarded the contract for the construction of Yuma dyke, Yuma project, Arizona-California, to Miller & Peasley, of Los Angeles, California. Four bids were received, that of Miller & Peasley—\$66,325—being the lowest.

**Utah Project
Approved**

The Secretary of the Interior has approved the preliminary plans of the engineers of the Reclamation Service for an irrigation project in northeastern Utah, known as the Strawberry Valley project, and as soon as the water users, through the Water Users' Association formed for the purpose, make proper adjustment of water rights and guarantee the return of the reclamation fund, construction will be promptly undertaken.



REV. DR. EDWARD EVERETT HALE

Chaplain of the United States Senate, and whose pen and voice have been enlisted on the side of practically every great movement of the last sixty years. Dr. Hale was among the very first to advocate the establishment of a White Mountain Forest Reserve.

Investigations by the Reclamation Service have been in progress in the State of Utah for over two years. These have extended to the reconnaissance of several localities and the possibilities of reclamation therefrom, and more detailed studies have been made of Utah Lake and the possibilities of its development, but these failed to develop a feasible project.

In the Strawberry Valley, on one of the tributaries of the Duchesne River, it is found that water can be stored in that valley and taken to the Spanish Fork by a tunnel. The capacity of the reservoir will be approximately 100,000 acre-feet, and the tunnel will be about 19,000 feet in length. Borings have been made along the line of the tunnel and no unusual difficulties have been discovered which might threaten the success of the project.

The lands which can be covered by the combination of stored water from Strawberry Valley and the natural flow of Spanish Fork consist of about 50,000 acres. Approximately one-half of this area is already irrigated but receives an insufficient supply of water. The land to be benefited is all in private ownership.

Owing to the uncertainties of estimates on the tunnel it is at present impossible to state with any degree of accuracy the cost of the project.

Michigan Forestry Meeting

The initial, or organizational meeting of the Michigan Forestry Association was held in Grand Rapids August 29 and 30, with a large attendance of lumbermen, business men, manufacturers, students, and others interested in forestry in Michigan. The first day's session was devoted to short speeches from a number of prominent members of the new Association, including Thornton A. Green, Loyal A. Knappen, Charles W. Garfield, Filibert Roth, George B. Horton, Hon. Arthur Hill, and others. The aim of the convention was expressed in the address of Prof. Roth: to get members to express their faith

in reforestation, to learn what to do, and to do it. Considerable enthusiasm was elicited through the appeal of Prof. Roth, and others, for reforestation in Michigan, and the adoption of conservative forestry throughout the state. At the final session on August 31, all editors of the state were voted honorary members of the association, with privileges of active membership. A vigorous campaign of education was outlined, and the following officers elected: President, John H. Bissell, Detroit; Vice-President, Thornton A. Green, Ontonagon; Secretary, T. M. Sawyer, Ludington; Treasurer, J. J. Hubbell, Manistee; Executive Board: Mrs. Francis King, Alma; C. J. Monroe, South Haven; Dr. Lucius Hubbard, Houghton; Walter C. Winchester, Grand Rapids; H. N. Loud, Au Sable; George B. Horton, Fruitridge.

With such a strong personnel, and with the energy displayed at this meeting infused into the vigorous campaign already planned, the Michigan Forestry Association will undoubtedly prove a power for good in Michigan.

Telephone for Reserves

For the better protection of the forest reserves the Forest Service, in co-operation with the Weather Bureau, will install a system of telephone lines and stations on them as rapidly as possible. The first system will be installed on the Big Horn Forest Reserve, in Wyoming. This telephone service will enable the forest rangers to notify one another, without delay, when forest fires break out. In so large an area as the Big Horn Forest Reserve, which comprises 1,151,680 acres, the value of rapid communication is obvious, and there can be no doubt that the elimination of delay will result in a striking improvement in the control of forest fires.

It is greatly to be hoped that this highly practical system of fire warning may be extended in due course to other reserves. This putting out of a forest fire may often depend upon immediate knowledge of its origin and

whereabouts; so that this new fire alarm device ought apparently to produce excellent results.

Mr. Clothier The Mississippi Agricultural and Mechanical College, at Agricultural College, Miss., has recently created the position of instructor of forestry and plant breeding in the institution, and Mr. George L. Clothier, of the United States Forest Service, has been chosen by the college authorities to fill this important position. In addition to giving forestry instruction in the college, Mr. Clothier will carry on propaganda work in forestry in connection with farmers' institutes and by means of bulletins issued from the agricultural experiment station.

In co-operation with the Forest Service a special study will be made of various forest problems of direct interest to the state, among which are: Forest Management for Woodlot Owners; Forest Planting for the Reclamation of Waste Lands; Method for Preventing Erosion Through Forest Planting and Preservation; Forest Survey of the State. The authorities of the state have shown themselves fully alive to the need of such work, and under the able direction of Mr. Clothier we may expect that the State of Mississippi will soon formulate a wise and practical forest policy.

Forest Reserve Personals Forest Inspector Benedict, of the Forest Service, is now in temporary charge of the Pinal Mountain Forest Reserve, in Arizona.

Mr. Robert J. Moore, forest ranger in the Madison Forest Reserve, in Montana, has been promoted to the position of Ranger in charge of the recently created Elk Horn Forest Reserve, in Montana, and established headquarters in Highwood, Montana, on September 20th.

Forest Ranger W. W. Hooper, who has been acting as ranger in charge of the Leadville Forest Reserve, in Colorado, has been placed permanently in charge of that reserve.

Forest Supervisor F. A. Fenn, of the Forest Service, reports from Boise, Idaho, that he assumed charge on September 1 of the Wiser, Sawtooth, and Fayette Reserves, in Idaho. He has been instructed to furnish the Department of Agriculture with the names of nine men for appointment to the position of forest ranger, to conduct the business of the reserves, until the results of the Civil Service examinations for the position of forest ranger are made known.

Mr. W. L. Veatch, of the Forest Service, has resigned from the post of supervisor of the White River Forest Reserve, in Colorado, and Forest Ranger Harry Gibler has been placed in charge temporarily.

Mr. Charles A. Scott, of the Forest Service, who has been making a preliminary examination of a nursery site to be used for reforestation purposes in the Garden City Forest Reserve, in Kansas, will visit the Black Hills Forest Reserve, in South Dakota, for the purpose of collecting bull pine seeds. The work of seed collection will probably engage Mr. Scott some three or four weeks, after which time he will return to Garden City.

Forest Supervisor James E. Meeks, of the Salt Lake Forest Reserve, in Utah, transmitted his resignation on September 12th. It was accepted and Forest Ranger E. H. Clark, of the Manti Forest Reserve, was ordered to go to Murray, Utah, to assume charge of the Salt Lake Forest Reserve.

Cooperative Work of Forest Service As a result of the attendance of a member of the Forest Service at the Farmers' Congress held at Amarillo, Texas, in August, a tree-planting club is to be organized in the Texas "Panhandle." This movement is of considerable importance since the region is naturally treeless, though there is abundant evidence that certain kinds of trees will grow, if properly planted and cared for. The object of the organization is to encourage the making of tree plantations, to experiment systematically with trees that seem likely

to thrive under the conditions there found, and to provide for obtaining the necessary planting material in the most advantageous way. When this club shall have been successfully organized, the Forest Service promises to send a man to the "Panhandle" to help the tree planters to make the most effective use of their land and planting material.

The study of railroad tie production which the Forest Service is making in co-operation with the Northern Pacific Railway Company, in Minnesota, is nearing completion. The field force is now in Hubbard county, where figures are being gathered to determine the possible yield in ties of jack pine. These figures, which were completed September 1, and show the yield of areas fully stocked with jack pine and will so be of value also in estimating the yield of planted areas. An estimate of the whole standing supply, and of the character of the lumber in northern Minnesota, is well under way.

The study of forest conditions in the southern part of New Hampshire, which the Forest Service is making in co-operation with the state, has progressed so well that the map work is now completed. The mapping of the northern part of the state was done in a previous forest study, also co-operative, so that the present maps supplement the former ones, with which they show forest conditions over the whole of New Hampshire.

On the forest maps are indicated the percentage of barren and abandoned lands, the area of forest land, the percentage of virgin timber, and the character of the forest, together with the area of burned land.

The attention of the field force will now be devoted to a study of second-growth spruce, with a view to determining its value as a woodlot species.

Application has been made for the purchase of 50,000,000 feet of western yellow pine timber in the Black Hills Reserve, located princi-

pally in South Dakota. This timber is classed as dead and insect infested. For the past five years a bark beetle has been preying on the western yellow pine of that region, and has done immense damage. The beetle bores through the bark, and the larvae seriously affect the wood. It becomes discolored to a depth of three or four inches, its strength is destroyed, and it thus becomes useless for timber. Every year the condition of the infested trees becomes worse.

Under the law none of the timber in this reserve can be exported from the State. The local demand is limited, and covers chiefly railroad ties, mine props, and general construction purposes. During the early stages of beetle attack the timber is good and should be promptly cut. There is possibly a quarter of a billion feet of such timber now in the reserve, very much of which will be wasted, as home consumption is not large enough to use it before the beetles have rendered it valueless.

Fire Protection for Nursery

For the protection of the forest plantations recently made in the mountains back of Pasadena, California, a system of fire breaks is being constructed. They follow the sharp "backbone" of the main ridges and are strips on which the brush is grubbed out for a width of from 12 to 30 feet, with connecting trails or secondary lines where needed. This is the first systematic and extensive work of fire-line construction attempted in these mountains and the cost thus far has been very reasonable. Upon the completion of these lines the nursery at Henniger's Flats and the new plantations will be well protected and the extensive sweep of a fire prevented.

Mr. Shaw Transferred

Mr. A. C. Shaw, chief of the Public Lands Division in the Land Office, has been transferred to the Bureau of Forestry, where he will act as examiner in matters of privileges, claims, rights of way, etc., within the National Forest Reserves.



HON. J. H. GALLINGER

United States Senator from New Hampshire, a conspicuous member of the Upper House of Congress. Senator Gallinger introduced a bill for the establishment of a White Mountain Forest Reserve at the last session of Congress. His reasons for the Reserve are clearly set forth elsewhere in this number.

FOR THE PRESERVATION AND FUTURE DEVELOPMENT OF A SPLENDID REGION

Why the American Forestry Association Favors the Creation of a National Forest Reserve in the Southern Appalachian Mountains

THE creation of a Southern Appalachian Forest Reserve would secure the best permanent development of a region of vast commercial and economic importance. Its resources have been steadily and dangerously depleted by reckless lumbering, by forest fires, and by flood. Without change in methods of management, this destruction will go on increasingly. Prompt and effective change in methods is possible only through government ownership and care.

That part of the Southern Appalachian region in which the proposed forest reserve will be situated is rich in timber, water power, and minerals. It also possesses limited, but definite, agricultural opportunities. It is of the first importance, not only to the region concerned, but to the whole South, that these resources be wisely used. The movement for the creation of the Appalachian Forest Reserve is not based upon sentiment. It rests upon the understanding of the commercial and economic advantage of the preservation by wise use, of resources which originally were vast, but already so far depleted that the end is clearly in sight.

RESOURCES OF THE SOUTHERN APPALACHIAN REGION.

Timber.—The greatest single resource of the Southern Appalachian Mountain region is its timber. The region contains the largest and the most valuable hardwood forest in the United States. Present methods of lumbering are reckless, expensive, and destructive, not only to the lumber industry itself, but to water power, and

to agriculture. Conservative methods of lumbering are not only necessary for the perpetuation of the forest, but advisable from every other point of view. Those interested in the lumber industry of this region will raise the question as to the effect of the establishment of the reserve on the production of lumber. Under government supervision conservative lumbering will not only be permitted, but encouraged. All mature timber will be sold at once, without waiting for a rise in timber values, as private owners so often do. The attitude of the government from a business standpoint, is well shown by the management of existing forest reserves. Since the administration of the federal forest reserves was transferred from the Interior Department to the Forest Service, of the U. S. Department of Agriculture, timber sales have increased five times in amount.

Not only will the cutting of all merchantable timber consistent with good management be encouraged, but dependant forest industries and the manufacture of forest by-products will be actively fostered. The net result will be not only to prevent decrease but make a steady increase, in production incident to the forest.

Water Power.—The application of the vast possibilities for the utilization of water power in the Southern Appalachian region have just begun. Water power values depend essentially upon constancy of flow, which in turn depends more than any other factor upon the maintenance of a permanent and sufficient forest cover on the mountain slopes. In the year 1901 alone, floods caused \$10,000,000 dam-

age to various property interests along streams rising in the Southern Appalachian region. Disastrous floods will continue to increase in severity unless mountain slopes are protected from fire and wasteful cutting. This region is one which receives an unusually heavy rainfall. The heavy mountain rain storms cannot, of course, be prevented, and it is but natural that with such torrential rains falling on steep mountain sides floods are bound to occur. But with proper care of the forests the danger and damage can be minimized. In order that these forests may be used to best advantage for water control, a change in their handling must come very speedily.

Agriculture.—The agricultural possibilities of this region would, under a reserve administration, be directed into proper channels. Those areas that are best suited to agriculture would be studied and pointed out, and the use of them encouraged, while the uselessness of attempting to farm the steep upper slopes of the mountains, as shown by the sad experiences of many settlers, would be averted. Careful forest management would directly benefit agriculture. Protection of mountain slopes would mean greater immunity from floods in the valleys, and consequently greater stability to agriculture.

Health and Pleasure Possibilities.—The health-giving qualities, and the beautiful scenery of this region are unequalled, and it is accessible to a larger number of people than any other in the United States. The establishment of the proposed forest reserve would insure in an adequate degree, the protection of fish and game, and offer opportunities for the building of resort hotels, summer homes, etc. It would encourage not only the business man to use the resources of the country, but it would be an effective and increasing impetus to settlement by people there for health and pleasure, and to tourist travel.

POLICY OF THE FOREST SERVICE IN HANDLING FOREST RESERVES.

The following extract from the regulations and instructions of the Forest Service in handling the western forest reserves gives a clear view of the government's attitude toward the public where their interests touch:

"The timber, water, pasture, mineral, and other resources of the forest reserves are for the use of the people. They may be obtained under reasonable conditions, without delay. Legitimate improvements and business enterprises will be encouraged."

FOREST RESERVE PRIVILEGES GRANTED BY THE FEDERAL GOVERNMENT.

The following are the more usual rights and privileges granted in the forest reserves, based upon demands already made upon the Forest Service. Other privileges which do not amount to a disposal of the land are granted. In fact requests for privileges are encouraged along any line that utilizes the resources of the reserves in a proper manner, the whole plan, as stated before, being to develop the resources of the forest reserves to their highest point of usefulness consistent with good business management.

(a) Trails and roads to be used by settlers living in or near forest reserves.

(b) Schools and churches.

(c) Hotels, stores, mills, stage stations, apiaries, miners' camps, stables, summer residences, sanitariums, dairies, trappers' cabins, and the like.

(d) Grazing and agricultural privileges, together with such inclosures, etc., as may be necessary for the use of such privileges and not harmful to the forest reserves.

(e) Canals, ditches, flumes, pipe lines, tunnels, dams, tanks, and reservoirs, within forest reserves.

(f) Steamboats and ferries operated within forest reserves.

(g) Aerial tramways and wire-rope conveyors.

(h) Railroad, tramroads, telegraph, telephone, or electric power lines, and

the plants or buildings necessary for their use.

(i) Other similar privileges which do not amount to a disposal of the land.

RESUME OF SOUTHERN APPALACHIAN RESERVE CAMPAIGN.

Nov. 22, 1899—Appalachian National Park Association organized at Asheville, North Carolina.

Jan. 2, 1900—Memorial of the Appalachian National Park Association presented to Congress and referred to the Committee of Agriculture.

April 17, 1900—Officers of the Park Association appear before the Committee on Agriculture presenting the cause of the Appalachian National Park Association.

April 21, 1900—Senator Pritchard introduced a bill praying for an appropriation of five thousand dollars for a preliminary investigation.

April 26, 1900—Senator Pritchard's bill asking for appropriation for investigation passed, became a law on July 1st.

Summer of 1900—The Bureau of Forestry, with the co-operation of the Geological Survey, investigate the Southern Appalachian Mountains.

Jan. 1, 1901—Secretary Wilson, of the Department of Agriculture, sends report to Congress through the President regarding the preliminary investigation made.

Jan. 19, 1901—President McKinley presents Secretary Wilson's report with a special message to Congress recommending this report to the favorable consideration of the Congress.

Jan. 10, 1901—Senator Pritchard introduces a bill praying for an appropriation of five million dollars

for the establishment of a forest reserve in the Southern Appalachian Mountains, approximating two million acres. Bill referred to the Committee on Agriculture.

Jan. 28, 1901—Senator Pritchard's bill asking for an appropriation of five million dollars was reported back favorably by the Committee on Agriculture.

Jan. 18, 1901—North Carolina passed a bill ceding to the National government the authority to acquire title for forest reserve purposes, with exemption from taxes.

Jan. 29, 1901—South Carolina and Georgia passed similar bills.

March 22, 1901—Alabama did likewise.

March 28, 1901—Tennessee and Virginia passed like bills.

July 3-10, 1901—Secretary Wilson, accompanied by Gifford Pinchot, chief of the Bureau of Forestry; J. A. Wilson, private secretary to Secretary Wilson; W. J. McGee, U. S. Bureau of Ethnology; F. H. Newell, U. S. Geological Survey; J. A. Holmes, State Geologist; Hon. Theo. F. Klutz, member of Congress of Seventh District of North Carolina, spent ten days in the Southern Appalachian Mountains making a personal investigation of the sites wherein it is proposed to establish the Appalachian Forest Reserve.

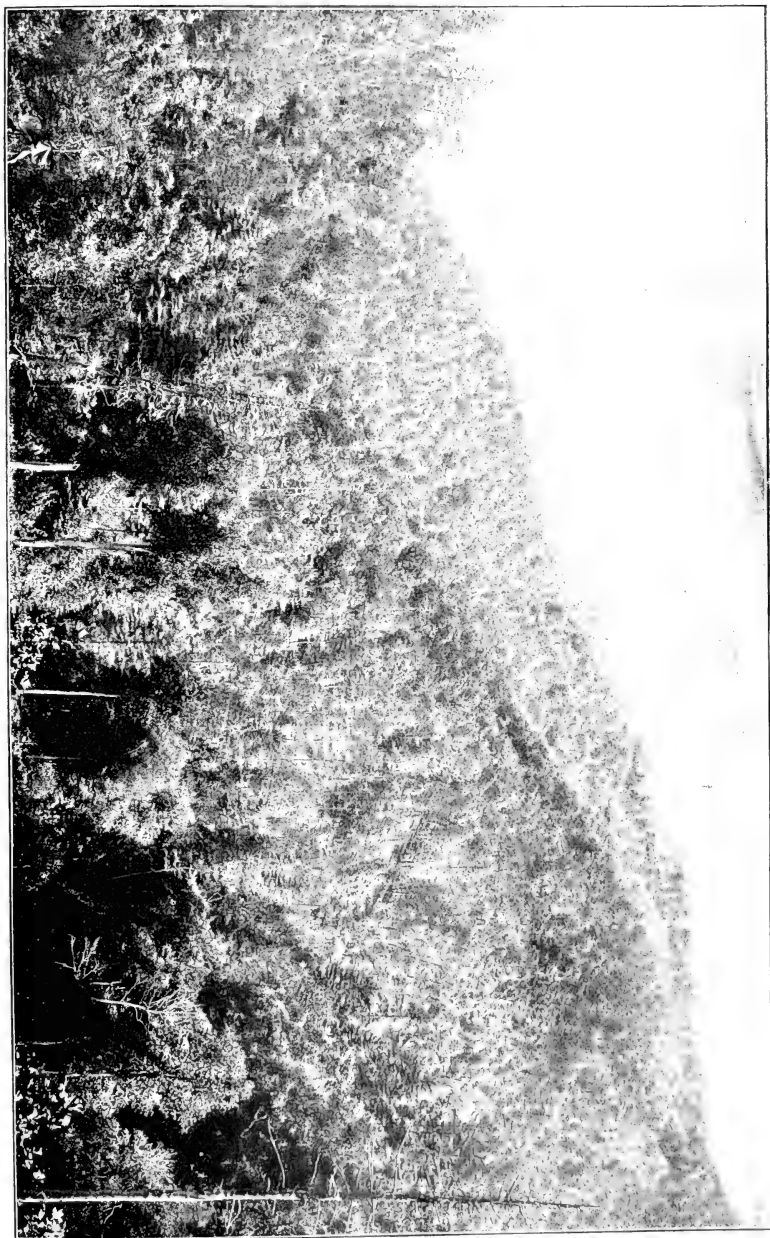
Dec. 10, 1901—President Roosevelt transmits report of the Secretary of Agriculture on the forests, rivers, and mountains of the Southern Appalachian region, to Congress, with recommendation that Congress consider it favorably.

In addition to the foregoing a bill in 1904 passed the United States Senate but the House took no action on it.



On the lower mountain slopes and ridges the pines are often mixed with the hardwoods. But whatever the nature of the trees, the frequent fires are destroying the undergrowth and humus and thinning out the trees, thus diminishing the commercial value of the forest, facilitating the erosion of the

Mixed Hardwood and Pine Forest on Oconalufy River, Swain County, N. C.



PRESIDENT FAVORS SOUTHERN RESERVE

Reprint of his special message to Congress in which he strongly favors the creation of a National Forest Reserve in the Southern Appalachian Mountains

To the Senate and House of Representatives:

I transmit herewith a report of the Secretary of Agriculture, prepared in collaboration with the Department of the Interior, upon the forests, rivers, and mountains of the Southern Appalachian region, and upon its agricultural situation as affected by them. The report of the Secretary presents the final results of an investigation authorized by the last Congress. Its

conclusions point unmistakably, in the judgment of the Secretary and in my own, to the creation of a national forest reserve in certain parts of the Southern States. The facts ascertained and here presented deserve the careful consideration of the Congress; they have already received the full attention of the scientist and the lumberman. They set forth an economic need of prime importance to the welfare of the South, and hence to that of the



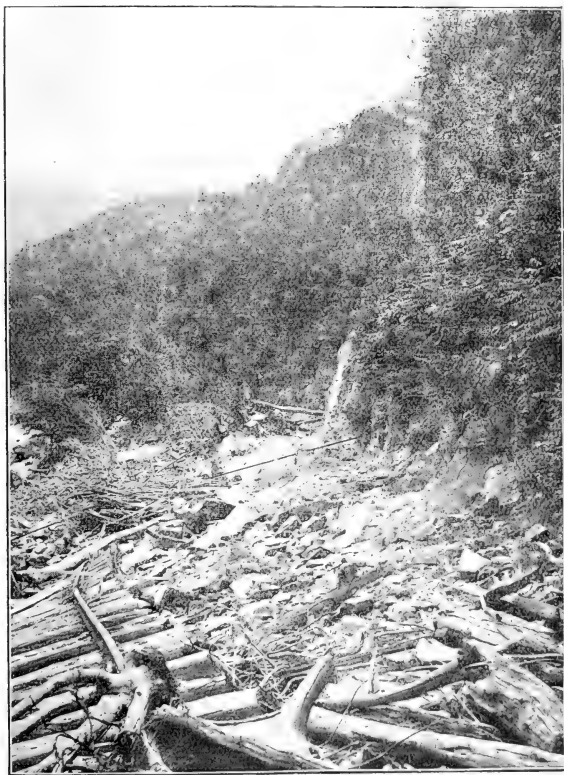
Debris from Floods on Nolichucky River, East Tennessee. May 21, 1901

This debris consisting of the wreck of farmhouses, furniture, bridges, cattle, and probably several human bodies, covered 6 acres of fertile farm land near Erwin, Tenn. The Southern Appalachian region is one with an exceedingly heavy rainfall, and though they cannot entirely prevent floods the preservation of the forests on the mountain slopes will minimize the damage from them.

nation as a whole, and they point to the necessity of protecting through wise use a mountain region whose influence flows far beyond its borders with the waters of the rivers to which it gives rise.

Among the elevations of the eastern half of the United States, the South-

wood forests were born on their slopes and have spread thence over the eastern half of the continent. More than once in the remote geologic past they have disappeared before the sea on the east, south, and west, and before the ice on the north; but here in this Southern Appalachian region they



View of Flood Damages on Doe River, Tennessee, May, 1901.

ern Appalachians are of paramount interest for geographic, hydrographic, and forest reasons, and, as a consequence, for economic reasons as well. These great mountains are old in the history of the continent which has grown up about them. The hard-

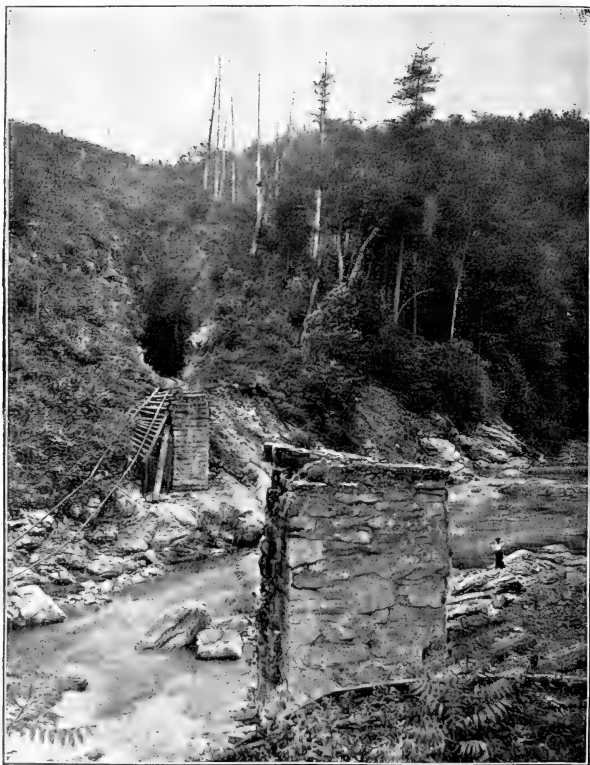
have lived on to the present day.

Under the varying conditions of soil, elevation, and climate many of the Appalachian tree species have developed. Hence it is that in this region occur that marvelous variety and richness of plant growth which have

led our ablest business men and scientists to ask for its preservation by the Government for the advancement of science and for the instruction and pleasure of the people of our own and of future generations. And it is the concentration here of so many valuable

The conclusions of the Secretary of Agriculture are summarized as follows in his report:

"1. The Southern Appalachian region embraces the highest peaks and largest mountain masses east of the Rockies. It is the great physiographic



Flood Damages to Railway on Nolichucky River, East Tennessee, May, 1901.

species with such favorable conditions of growth which has led forest experts and lumbermen alike to assert that of all the continent this region is best suited to the purposes and plans of a national forest reserve in the hardwood region.

feature of the eastern half of the continent, and no such lofty mountains are covered with hard-wood forests in all North America.

"2. Upon these mountains descends the heaviest rainfall of the United States, except that of the North Pacific

Coast. It is often of extreme violence, as much as 8 inches having fallen in eleven hours, 31 inches in one month, and 105 inches in a year.

"3. The soil, once denuded of its forests and swept by torrential rains, rapidly loses first its humus, then its rich upper strata, and finally is washed in enormous volume into the streams, to bury such of the fertile lowlands as

to the Mississippi. Along their courses are agricultural, water-power, and navigation interests whose preservation is absolutely essential to the well-being of the nation.

"5. The regulation of the flow of these rivers can be accomplished only by the conservation of the forests.

"6. These are the heaviest and most beautiful hard-wood forests of the



Valley Lands Badly Washed by Floods.

These fertile lands in the Southern Appalachians will all be washed away in a few decades unless the forests on the mountain slopes are protected.

are not eroded by the floods, to obstruct the rivers, and to fill up the harbors on the coast. More good soil is now washed from these cleared mountain-side fields during a single heavy rain than during centuries under forest cover.

"4. The rivers which originate in the Southern Appalachians flow into or along the edges of every State from Ohio to the Gulf and from the Atlantic

continent. In them species from east and west, from north and south, mingle in a growth of unparalleled richness and variety. They contain many species of the first commercial value, and furnish important supplies which can not be obtained from any other region.

"7. For economic reasons the preservation of these forests is imperative. Their existence in good condition is

essential to the prosperity of the lowlands through which their waters run. Maintained in productive condition they will supply indispensable materials, which must fail without them. Their management under practical and conservative forestry will sustain and increase the resources of this region and of the nation at large, will serve as an invaluable object lesson in the advantages and practicability of forest preservation by use, and will soon be self-supporting from the sale of timber.

"8. The agricultural resources of the Southern Appalachian region must be protected and preserved. To that end the preservation of the forests is an indispensable condition, which will lead not to the reduction, but to the increase of the yield of agricultural products.

"9. The floods in these mountain-born streams, if this forest destruction continues, will increase in frequency and violence, and in the extent of their damages, both within this region and across the bordering States. The extent of these damages, like those from the washing of the mountain fields

and roads, can not be estimated with perfect accuracy, but during the present year alone the total has approximated \$10,000,000, a sum sufficient to purchase the entire area recommended for the proposed reserve. But this loss cannot be estimated in money value alone. Its continuance means the early destruction of conditions most valuable to the nation, and which neither skill nor wealth can restore.

"10. The preservation of the forests, of the streams, and of the agricultural interests here described can be successfully accomplished only by the purchase and creation of a National Forest Reserve. The States of the Southern Appalachian region own little or no land, and their revenues are inadequate to carry out this plan. Federal action is obviously necessary, is fully justified by reasons of public necessity, and may be expected to have most fortunate results."

With these conclusions I fully agree; and I heartily commend this measure to the favorable consideration of the Congress.

THEODORE ROOSEVELT.

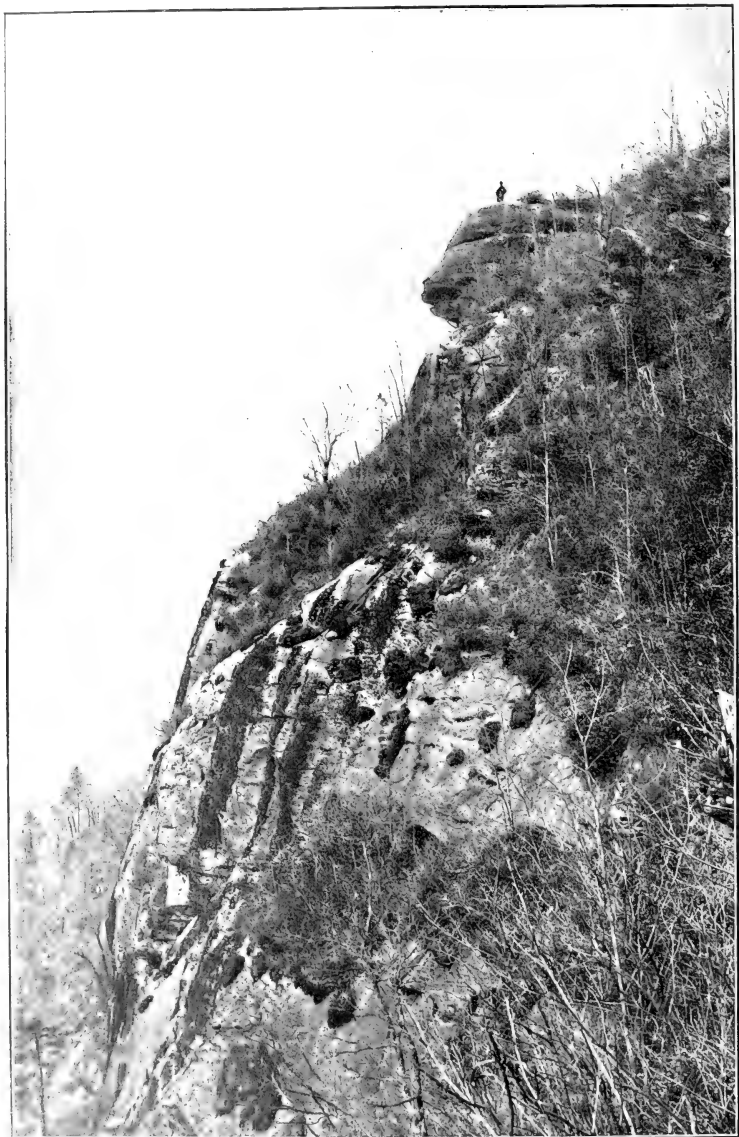
White House, Dec. 19, 1901.



Flood Damages to Mining Settlement, Norwood, W. Va., 1901



An Original Southern Appalachian Mountain Forest, Transylvania County, N. C.



Caesars Head, South Carolina.

The fires and axe are destroying the best growth on these steep, rocky mountain sides.

VALUE OF A FOREST RESERVE TO NEW ENGLAND

BY

J. H. GALLINGER

United States Senator from New Hampshire

THE sentimental side of a White Mountain Forest Reserve has been warmly discussed during the past few years, and in all parts of the country it has its able and eloquent advocates. The æsthetics of the situation appeal strongly to all who have visited the White Mountain region, and personally witnessed the devastation of the magnificent forests that is now under way. It is not strange that lovers of the beautiful should unite in protesting against the wholesale destruction of the timber lands of Northern New Hampshire, and I am glad to unite with them in any effort that will tend to stay the ravages of the unscientific and wasteful methods now in vogue. But there is a practical as well as a sentimental side of the question, to which I beg briefly to call attention.

The important relation between the perpetuation of the forest and the abandoned farm is not always appreciated. When lumbering ceases, the mills and other wood-working industries disappear, and the farms in many parts of New England no longer pay, so that the farming people move away. It is a curious fact that some of the problems of the Orient in ancient times and of Italy in Roman times are being repeated in our day on American soil. But our people are slowly learning that an intelligent use of the forests will perpetuate its products, and steady the industries dependent upon them. The forest product in New England, especially in the last decade, since paper has been made in large quantities from spruce pulp, is of the utmost importance. It ranks next in

value to agriculture and manufactures, and includes not only lumbering, saw mills, and paper and pulp mills, but also the many wood-working factories that make articles all the way from furniture to shoe pegs. We are told in the latest census that in New Hampshire alone there are \$8,163,081 invested in 29 paper and wood pulp plants, employing 2,391 persons, paying annually \$1,036,856 in wages, and producing annually a gross product valued at \$7,244,733.

These figures are for one of the forest industries in one of the New England States, but they suffice to show the great number of families dependent upon the forest—families of woodsmen, mill hands, factory operatives, managers and owners. In the well being of the forest all New England is vitally interested, and the sentimental argument of saving the forests to be sure of summer boarders is inconsequential in comparison with other and greater interests which are affected. The proper care of the remaining spruce forest, and of our hard wood and second growth trees, should be undertaken promptly, in order that we may not suffer in New England as we did from the disappearance of the primeval crop of white pines.

Because of the time element involved it is not possible for individuals, nor even for corporations, to cut the forests in a manner that ensures a future crop. To hold the property involves, as a rule, a loss in taxes and fire protection that benefits only a future generation. The principle is now recognized in many of our States, in New York, Pennsylvania, Michigan

and others, and by the National Government in setting aside 80,000,000 acres of forest reservation in the West, a territory larger than all New England, that for non-agricultural lands,

other New England States anxious to secure a national forest reservation of sufficient size to guarantee the continued navigation of those streams, their uninterrupted use as manufac-



Mount Bond, New Hampshire, Showing Clear Cutting on the Upper Slopes.

government ownership alone ensures a profitable return.

The flow of nearly all of the important rivers of New England from the White Mountain region makes the

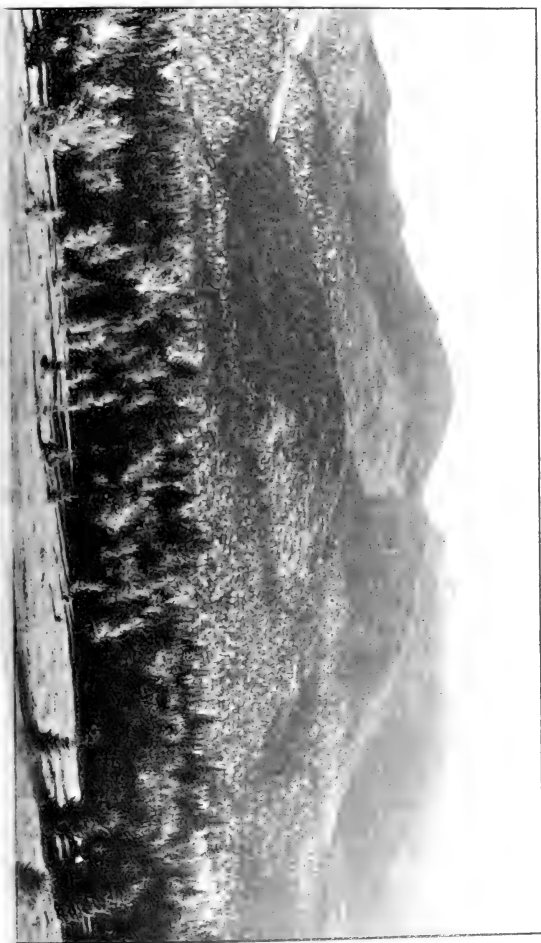
turing power, and the security for domestic purposes in the cities to which they supply drinking water. Such a reservation would add steady the wood-working industries of all New

England. Can any matter be more far-reaching in its influence?

New Hampshire has appropriated \$5,000, with which a careful examina-

tional Government to the utmost in the effort to make the proposed reservation a fact; but unfortunately New Hampshire is not financially able to

The Randolph Forest on the Presidential Range. Four hundred men have been cutting in it for three years. One more winter (1905-6) will finish it. Only one other primeval forest, less attractively situated, remains on the Presidential Range.



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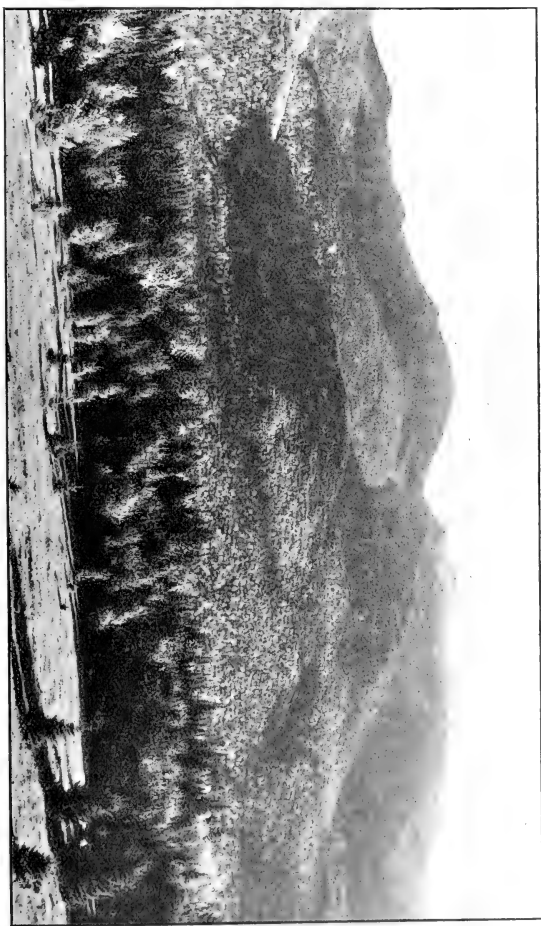
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AN APPALACHIAN FOREST RESERVE AND THE SOUTH

The immense importance of it to the industries of the South—Why the South should warmly support the project

BY

BENJAMIN LAWTON WIGGINS, L. L. D.

Vice Chancellor, University of the South

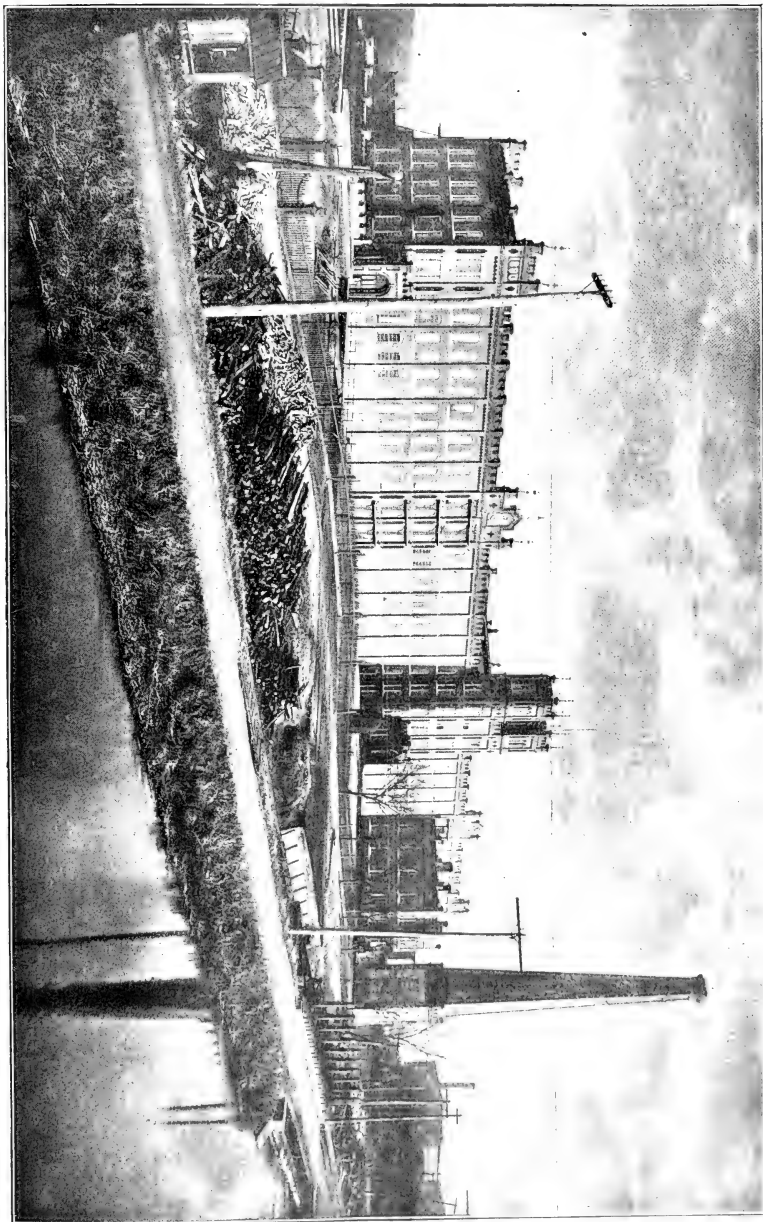
THERE are few more hopeful signs of progress in material things than the growing interest on the part of the American people in the protection of their forests. It is true that our timber interests are mainly owned by private capital, and in all likelihood will ever be so appropriated; but the influence of these gifts of nature on the general happiness and well-being of the human race has always given to them a semi-public character which can be easily understood. Never before in our history, however, has the subject of forestry been more earnestly and widely considered than now.

Surely the leading causes of this cheering indication is a recognition of the evils inflicted on all classes of society by the wholesale demolition of our timber districts and the growing conviction that unless some prompt check is imposed on this destructive process, even greater losses are to be expected. And, as has been frequently pointed out, these losses are not to be confined to this generation, but will be entailed on posterity. That we of the south are fast awakening to the sad reality now confronting the rest of the country is therefore only another striking proof of the fact that the interest of each of us is the interest of all. Hence the movement, now of several years' growth, which has for its object the protection of the timber interests in the southern Appalachian Mountain region, is at once a sign and a promise of better things to come.

One of the most striking features of the proposed reservation is the vast area of territory stretching from West Virginia and Virginia through Tennessee and the Carolinas to Georgia and Alabama. But even this does not represent the actual influence exerted by the vast region just indicated. For we must remember that the Appalachian district is the source of many of the most important rivers in fully one-half of the Southern States. In other words, those who are advocating the protection of the Appalachian forests are endeavoring to safeguard the farming, commercial, and manufacturing interests of one of the most important sections of the United States.

For there is scarcely an industry in any of the states touched by the proposed Appalachian reservation that is not directly affected by the river-systems whose reservoirs are in these mountain forests. This becomes plain to us when we recall, for example, the alarming frequency of those destructive freshets, due largely to the demolition of mountain forests, which not only impoverish the agricultural lands by robbing the soil and bring numberless woes to the farmer; but they also choke up our rivers and harbors, thus obstructing commerce, and imperil the rare wealth we have in the way of water power to propel the machinery of our mills.

Colonel William Elliott, of South Carolina, in a speech delivered in Congress on May 14, 1901, used the fol-



Improved Water Power on the Savannah River, at Augusta, Ga., Operating Cotton Mills.

The principal sources of this and other important rivers of the Southeastern States are within the region of the proposed Appalachian forest reserve; and the perpetuation of the water powers on these streams, valued at more than \$20,000,000 per annum, depends largely upon the preservation of these mountain forests.

lowing words which every well-wisher of the South might well lay to heart:

"Take, for example, the rice plantations on the South Carolina side of the Savannah River, which has its source in these mountains. Formerly they were more productive. The lands were exceedingly valuable. They were all cultivated in the most careful manner and yielded splendid returns. Whoever was so lucky as to own one of them was considered a rich man. What is their condition now? Many

which commenced some twenty years ago, just before the time when destructive freshets became so frequent."

It is well to bear in mind that the exhaustion of the timber resources of other sections of the country, together with the wonderful industrial development of the South during the past two decades, has produced an enormous demand for all kinds of southern lumber, not to speak of the devastating effects of forest fires. It is true these and similar dangers arising from a



Water Power on Broad River at Columbia, S. C.

of them, including their elaborate and expensive systems of irrigation, have been substantially abandoned, and the remainder generally show a loss at the end of the year instead of a profit. In the course of less than twenty years there has been a complete revolution from a state of great prosperity to one of utter prostration. What is the cause of all this? None other than freshets, all the time increasing in number and destructive power. All the evidence goes to show that the cause is the destruction of our mountain forests,

neglect of our best interests have been frequently pointed out. It is true we have in our various states Arbor Days and Forest Associations and sundry statutes directed against wantonly setting fire to woods. But the practical objects—indeed the impossibilities in the way of separate state control of the proposed reservation are obvious.

It is a matter of national importance and ought to be entrusted to federal administration. No part of the country need gain more by transferring the management of this proposed domain

to the general government than the Southern States. Their commerce, their agriculture, their manufactures demand a constant and uniform flow of water. This cannot be expected so long as the present state of things continues. On the contrary, unless some steps are immediately taken to conserve our reservoirs in the Appalachian region our rivers will not only become more torrential in the spring, but diminish in summer.

Even if the states were able to buy the rare region in question, which is

trial life of the South by the construction of the Panama Canal, the necessity, indeed the duty of protecting the Appalachian forests is thrust upon us in the most forcible manner. It is something more than a present economic necessity, involving the welfare of the South, it is one of those great secular interests affecting future generations of Americans.

There can be little doubt that the failure thus far to establish a Southern Appalachian Forest Reserve is due, in large measure, to the apathy



Water Power on Saluda River at Pelzer, S. C.

exceedingly doubtful, they would be unable to manage it with their lack of experience. Moreover, there would be seven or eight State Boards of Control with every opportunity for dispute and irritation. Of course the great object lesson it would afford us for still further protecting other regions unaffected by the rivers whose sources are in the Appalachian district can be readily understood.

When we consider the tremendous impetus that will be given the indus-

of the people who are most immediately concerned. Two Presidents have recommended it as of great public utility. The Secretary of Agriculture stands as he has stood from the beginning, upholding the project—yet it has advanced but little in the four or five years that the measure has been before the people. If this reserve is ever to be an accomplished fact it will be due to the people of the Southern States; not those who own land within the area that may be bought up, not



Stone Mountain Near Atlanta, Georgia.
The forest at the base of the mountain, and the heavy rains have removed the soil which once covered the larger part of this rocky knob.

those who are on the borders of it, but the vastly greater number who live and do business in the country surrounding the mountain region.

From these highlands come the waters that make fruitful the farms and give power to the industries of practically every Southern State east of the Mississippi River. The people of the North and West realize that this question is first of all a local one—at any rate that one section of the country is more immediately concerned than any of the others. Yet they also see that it is a matter of importance to the entire country, and for this reason are ready to turn in and put their shoulders to the wheel to get this reserve. But they must first be assured that the South is heartily in favor of it; therefore it is directly up to the people and press of the South to head this great work with vigor.

Furthermore, all that the Adirondacks are to New York, the Berkshire Hills to Massachusetts, the White Mountains to New Hampshire, and all of them to the whole country, these southern mountains may be to the states that possess them. The American people are developing a love of outdoors that must be satisfied. No region in the United States has the qualities that attract the summer visitor and the possibilities of ready access, that the forested mountains of the South have. Private enterprise is slow in making them known. A great forest reserve there will create a demand that every part be opened to travelers.

So regarding it let us act promptly and wisely. And reason surely points out one way and that is to entrust the management of this magnificent domain to the wise, liberal, comprehensive administration of the general government.

REASONS FOR A NATIONAL FOREST RESERVATION IN THE WHITE MOUNTAINS

BY

PHILIP W. AYRES

Forester of the Society for the Protection of New Hampshire Forests.

THE reasons for a National Forest Reservation in the White Mountains are of two kinds, economic and æsthetic, of which the economic reasons are by far the more weighty and important.

1. The lumber interests in New England, including the pulp and paper plants and the wood-working factories, are second only to agriculture and manufactures in the amount of wages paid and the number of families supported. Anything that attacks any one of these great interests affects all of the others, and the lumber in-

terests is easily the most vulnerable because of the easy exhaustion of supply. A forest reservation would steady the towns, mills, and factories whose population is dependent on forest products.

From the complete exhaustion of their primeval white pine forests some years ago, the New England States have suffered severely. The furniture factories and many other wood-working plants have largely disappeared. Such sash-and-door factories as remain import their pine from Michigan and the West at a price that renders

them less able to compete in the general market. Such items are fundamental in New England's welfare. There is a supply of standing spruce on hand sufficient to keep the paper and pulp plants at work for twenty years at the present rate of consumption, and with the increase in population throughout the country, the rate of consumption is almost sure to in-

England establishments? It is not surprising that the paper makers and the lumbermen are in favor of a forest reservation in New England. The American Paper and Pulp Association, at its meeting in New York last year approved of a reservation in the White Mountains, and asked Congress to take speedy action. The National Wholesale Lumber Dealers' Associa-



Virginia Spruce with Dense Balsam Reproduction on Mt. Jackson, New Hampshire.

crease. The areas of spruce in the United States suitable for the manufacture of paper are limited, but they are said to be extensive in Canada. Shall we have to import supplies from Canada? (Thirty-seven per cent of the spruce used in New Hampshire last year was imported from there.) Will our paper mills move into Canada, or will new mills be erected in Canada to compete with our New

tion, and the National Board of Trade meetings in Washington did the same. So did the American Forest Congress.

One reason why the Black Forest region in Germany is such a thriving manufacturing center is because the forests are owned by the government, the towns, and universities, and so managed that there is no danger of exhausted supplies. Compare this

with the ephemeral lumber town in this country.

2. The second strong reason for a forest reservation in New England, is that it would protect the water flow. A majority of the rivers in New England rise in the White Mountain region. The most important of these are the Connecticut, the Merrimack, the Saco, and the Androscoggin. Great enterprises are dependent upon their equable flow. They are the main source of power for the concentrated manufacturing establishments in New

the Merrimack is dependent upon the mountain forests, though in less degree than the Connecticut and the other large rivers.

3. Because all of New England is vitally affected, having interests that are paramount to those in any one state, the proposed reservation in the White Mountains is a matter for federal action. New Hampshire and Massachusetts have the most at stake, though Maine, Connecticut, and Vermont are not far behind. New Hampshire appropriated \$5,000 for an ex-



Barren Upper Slopes in the Presidential Range, White Mountains.

England, particularly of those making paper and cotton-cloth. Upon their purity depends the health of those large cities that use their waters for drinking purposes. Although certain manufacturing concerns on the Merrimack have not thus far shown a marked interest in the plans for a reservation, owing to the fact that the Merrimack has enormous natural reservoirs in Lake Squam, Lake Winnepesaukee, and Newfound Lake, with dams at their outlets making more even the flow in this river, yet it is true that the flow of

amination by the United States Forest Service of the entire mountain region. This examination has been made, and the report is replete with facts giving a full account of the situation as to the location of forest lands, their extent, condition and value, the influence of lumbering, fire and erosion. It shows also the effects of present management. The bill before Congress has reservation may not interfere with the progress of agricultural or other private holdings, nor with the forest income carefully drawn in order that a



North Sugar Loaf Mountain, Once Heavily Timbered, but now Practically Barren as a Result of Clean Cutting and Fire.

terests of those who will cut in accordance with rules laid down by the Secretary of Agriculture.

The New Hampshire Forestry Commission, and the Society for the Protection of New Hampshire Forests are



View Showing Results of a Severe Ground Fire in White Mountains

alert to render any possible assistance. So is the Massachusetts Forestry Association, and the Appalachian Mountain Club. The following public bodies in New England have asked Congress to take favorable action:

Connecticut State Lumber Dealers' Association, Rhode Island State Lumber Dealers' Association, New Hampshire Lumbermen's Association, New

ple from many states. Scarcely any other national playground is so largely used by the people of so many states as a refuge from the pressure of business and social life in the large cities. This was the foundation of Dr. Edward Everett Hale's address before the American Forest Congress last winter. The White Mountains are one of the nation's breathing places, and



Forest Lumbered Twenty Years Ago to a Diameter of Fourteen Inches—Now Ready for Another Cutting.

Haven and Coastwise Lumber Dealers' Association, Boston Merchants' Association, Boston Lumber Trade Club, Boston Associated Board of Trade.

4. The æsthetic value of a forest is a legitimate value. The White Mountains afford rest and recreation in one of the most thickly populated portions of the country, and are sought by peo-

ple should not be despoiled of their beauty. There are elms enough for wagon hubs without taking the most beautiful trees in the village street, and there is wood enough for furniture and paper without removing the few remaining primeval forests in the White Mountains. It is a question of how these forests best serve mankind, by standing or by being cut.

There are but two primeval forests remaining on the Presidential Range. The more attractive, the Randolph Forest, from which rise the peaks of Jefferson, Adams, and Madison, has been three-fourths removed in the last three years, leaving prominent ugly scars in its place on the mountains. The last and best fourth of it, up the "valley way" on Mount Madison, will probably disappear in the coming win-

tive action.

In addition to these reasons for a reservation in New England, a word should be said for the principle of a government ownership of non-agricultural land. There has been a great outcry against the lumberman which has been of no avail. It is also without reasonable foundation, for why should he, more than others, have rent Minnesota lumberman, has well



Land Cut Clear and Burned Over About Ten Years Ago.

ter. The other primeval forest is less accessible, on the Pinkham Notch side of Mt. Washington, and is threatened "for commercial purposes," having recently changed ownership. It is now too late even with prompt action, to do what could easily have been done two years ago. Four of the Sibylline books have been destroyed. But there is still sufficient reason for prompt and posi-

said, "The State has interests far beyond those of the individual." It is because the State is neglecting these interests that we suffer. Let us direct the energy that we have hitherto wasted in denunciation, into the more useful channel of State and National acquisition of lands not fit for agricultural for the future welfare of the people? As Mr. Weyerhaeuser, a promi-

ture. The States governments in New York, Pennsylvania, and Michigan, have made splendid beginnings. The federal government has set aside 80,000,000 acres in forest reservations in the West. They are even more important in the East, where population is more dense. By this means alone

can the great industries dependent upon wood supply be made permanent and steady. By this means alone can the water flow in great rivers be protected. When adequate reservations are secured there will be no lack of attractive forests in which tired humanity can find rest.

FOREST RESERVES IN IDAHO

Interesting Discussion of Forest Reserve Situation in Idaho and Explanation of the Federal Forest Policy in General.

AN unusually interesting correspondence relating to the general forest policy of the government has just been published by the Forest Service, as Bulletin No. 67, entitled "Forest Reserves in Idaho." The major part of this correspondence, which deals specifically with forest reserve questions in Idaho, consists of letters from Senator W. B. Heyburn, of Idaho, to the President; the replies of the President; letters from Mr. Gifford Pinchot, Forester of the U. S. Department of Agriculture; and a letter on the federal forest reserve policy, with special reference to Idaho, by Senator Fred Dubois.

The discussion of the forest reserve situation in Idaho, which is very fully developed in the letters, and a thorough explanation of the federal forest policy in general, which has never before been so clearly and emphatically defined, lend to this bulletin exceptional and more than merely local interest.

Senator Heyburn, in several of his letters, makes warm protest against the proclamation of certain forest reserves in Idaho. His colleague, Senator Dubois, on the contrary, enthusiastically recommends their establishment, and declares that "to-day the forest reserves are administered * * * for the sole purpose of conferring the greatest benefit on the communities in which the respective reserves are situated."

One of the most striking passages of Senator Dubois's letter is that in which he asserts that the federal administration is now in fullest harmony with the desires of disinterested citizens throughout the West. He declares that he never at any time opposed the policy itself, though at first, with colleagues from the Rocky Mountain region, he "contended against the methods which were used in creating, maintaining, and controlling the reserves." "During the time when the forest reserves were first created," he writes, "reserves were created without sufficient safeguards to protect stock raisers, miners, lumbermen, agriculturists, and people of our section generally. The fight of the western men was constant and united. Our demands were set forth in numerous speeches, and finally were acceded to. The policy which controls the creation of forest reserves to-day and their administration is substantially the policy which the Representatives of the Western States in Congress have contended for, and is substantially what the West, through its Representatives, contended for."

The President, in one of his letters, replies vigorously to the protests of Senator Heyburn. The following sentences occur:

"The government policy in establishing national forest reserves has been in effect for some time; its good

results are already evident; it is a policy emphatically in the interests of the people as a whole, and especially the people of the west; I believe they cordially approve it; and I do not intend to abandon it."

The specific withdrawals in Idaho which Senator Heyburn opposed and which Senator Dubois recommended, now established as reserves or as additions to reserves, are as follows: Henrys Lake, Sawtooth, Payette, Squaw Creek Division of the Weiser, and Cassia, and additions to the Yellowstone and the Bitter Root.

Appended to the correspondence is a report of Special Agent Schwartz, of the General Land Office, based on "certain examinations of the Shoshone Forest Reserve temporary withdrawal,

in Idaho."

In the discussion of the advisability of withdrawing certain lands for forest reserves, it was objected that forest reserves discouraged settlement and worked hardship for those who had already acquired claims within the areas affected. According to the report of Special Agent Schwartz, about 90 per cent. of the claims which he examined have never been resided on by their claimants, as is required by law. It would appear, furthermore, that a considerable number of the claimants are railroad employees and others whose interests in their claims seem very indirect. On the whole, the report goes to show that the claims examined are in a large number of cases not legitimately held.

TRANSPLANTING OF BIGTREE SEEDLINGS

BY

S. J. FLINTHAM

Forest Assistant, U. S. Forest Service.

THE ancient race of the Sequoia, species of which in prehistoric times flourished over a wide range in North America, seems, from the destructive course of lumbering through the restricted present range of the two Sequoia species,—in the Coast and Sierra ranges of California, to be in a fair way to become extinct in time or to be maintained only in a few protected National Parks and Forest Reserves.

Despite their great antiquity both the species are of great virility. The coast redwood, reproducing itself readily by sprouting from the stumps after lumbering as well as by abundantly-produced seed, seems capable if protected of recovering its cut-over lands to some extent, and to have within its range a future timber importance in forest operations.

With the bigtree, however, such recovery appears more difficult. The species does not reproduce by sprouts, and though its light, wind-blown seed is spread to some distance, young growth is hardly to be found extending outside the well defined limits of the bigtree groves, and within them reproduction grows with difficulty under their shade.

The seed of the bigtree commands a good price. It is collected and the species propagated by nurserymen both at home and abroad, but mainly as an ornamental tree. Neither sapling nor young seedling reproduction is very abundant in the bigtree groves on the Sierra slopes, and little or no attempt has been made to transplant the wild forest-grown seedlings.

An interesting experiment, however, which has proved an entire success,

begun independently and continued with the approval of the Land Office, was started in the early spring of 1904 by Ranger L. L. Davis in charge of the General Grant National Park. He has succeeded in setting out small bigtree seedlings, collected from a few localities where they had come up naturally, to various sites about the park, in openings where they will be allowed a better chance to grow up.

The naturally sown seedling sites mentioned occurred where light ground fires, spread from small fires for the clearing up of the rubbish on the forest floor, had cleaned the ground of a heavy accumulation of litter. The germination of the seed of the bigtree is slightly difficult—ordinarily hindered by the heavy trash and litter accumulating under the Sequoia stand, but an opportune seed year allowed advantage to be quickly taken of such favorably cleared spots, and seedlings now two or three years old have started several thousand times as dense as they can live to grow up, the number of seedlings averaging on some spots over 2,500 to the square rod.

Noting this crowded reproduction Mr. Davis conceived the idea that the transplanting of such seedlings from their frequently close-crowded position under shade, where they were sure to die out, was entirely practicable, and his experiments in 1904 were sufficient to indicate the exact size of plants, and the methods of transplanting which will give most assured success, and allow the reproduction in the park to be very largely extended.

In 1904 some 800 plants were transplanted, Mr. Davis doing the work unaided. The trial was entirely satisfactory, as very few seedlings died even when set out in unfavorable conditions of soil moisture. The plantation came through a summer exceptionally hot and droughty, even at the elevation—about 6,000 to 7,000 feet, of the park, and though the watering of the transplants, carried on into midsummer,

had then to be abandoned because of failing water supply.

The available supply of plants, of the size which the past experience showed to be the most desirable, was short for the spring of 1905, and only 600 more seedlings were set out, though the transplanting is to be continued and extended, and a large supply of forest-grown stock should be of suitable size and maturity the spring of 1906. For the future further supplies of naturally sown stock is also being provided for by the burning off of the surplus litter in several places in the park to catch the fall of seed from good seed years such as occurred the fall of 1904.

In the 1904 planting seedlings of a size between 1 and 18 inches high were dug up carefully to avoid injury to the long taproot system, were carried in pails in a puddle to the planting sites—generally the small fire-opened spots in the forest, and set out in deep, watered holes, the whole root system being carefully spread out, and the hole filled in with fine earth. They were set out at the rate of about 100 a day.

Planting two seedlings together was at first tried, but as both seedlings always lived the practice was discontinued. No deaths resulted from a severe freeze, which occurred in April immediately following the transplanting when the soil was bare of snow. Some trouble was experienced with ground squirrels, which occasionally dug up the transplants, but they were readily poisoned off.

The transplants came successfully through the summer, in spite of the cessation of the watering at the time of greatest need, and nearly all the seedlings were thrifty when measured in the latter fall of the year. As might be inferred from the very successful sapling growth of the species in open cut-over lands, from which bigtrees have been lumbered, the best of the transplanted growth occurred where there was most abundant light. Plants of 6 to 10 inches height grew from 5

to 8 inches in the season. Most of the plants set out were from 4 to 18 inches in size—that is 2 to 3 years old. These have taproots often 1 to 2 or more feet long, and they are therefore transplanted with some difficulty, and if with proper care at some expense of time. However, some plants 1 to 4 inches high, or 1-year-old, were set out, which did not succeed so well. Most of the 10 per cent loss noted at the end of the first season was confined to this size class. It is evident, therefore, that the larger sizes must be used for transplanting, in spite of their less suitable root system, and for succeeding years 4 to 10-inch stock will be employed. Failures were due to the inadequate root system,—not sufficiently developed to reach moisture deeper in the soil, and so to maintain the plant against the summer's drought.

Seedlings are thus seen to be hardy to drought and frost, but are best suited by rich moist soil. Experiment has shown that they may apparently be planted and succeed beyond the natural altitude range of the tree in the existing groves. Young seedlings are also occasionally dug up by ranchers and homesteaders living in the val-

leys in the foothills, during visits made to the bigtree groves. The Sequoia saplings occasionally seen in the door-yards of ranches in the foothills and in yards in the towns through the San Joaquin Valley have generally been thus transplanted successfully from the groves in the mountains. They are here succeeding—making exceptionally thrifty growth, and developing into fine ornamental trees, at altitudes of from 300 or 500 feet up to 2,500 feet.

This experiment in the General Grant Park, and the success that has attended it, points the way for the improvement by the officials in charge of other bigtree groves. The presence of a protected and well distributed reproduction, now lacking in most groves, could be gradually brought about in the Sequoia and Yosemite National Parks by similar transplanting by the members of the ranger service, and much interest for visitors would be added from the visible comparison in the groves of the seedlings and saplings of the bigtrees growing under the broad spreading crowns and massive columns of the mature giants, while the rapid growth of the saplings would later furnish trees of pole size, now only infrequently met with.

SPRUCE SEED SOWN BROADCAST

BY

A. KNECHTEL

Forester, New York State Forest, Fish and Game Commission.

IT is a matter of common observation that evergreen trees spring up readily in poplar groves, and hence a notion has become prevalent that spruce finds in such places good conditions for reproduction, and that spruce forests might be started by scattering the seed under the poplar trees. To put the matter to a test, the Forest, Fish and Game Commission of New York sowed in 1903 about a

bushel of native spruce seed in the poplar groves near Aiden Lair, Essex county, New York. The ground was quite well covered with poplars which ranged in diameter from four to ten inches. There were no small evergreens beneath them, nor were there any large spruce trees nearby from which seed might be shed. Therefore, any spruce trees that have begun to grow there during the past three

years, may be considered as having come from the seed sown.

The seed was scattered on the fallen leaves, on decaying wood, and especially on all spots where the mineral soil was exposed, and these were quite numerous. About eight quarts of seed were put on an acre.

The seed received immediately several showers, but from April 4th to June 11th no rain fell in the Adirondacks.

In July, 1904, an examination of the ground was made. Where mineral soil had been exposed, and on rotten wood, the little trees were doing quite well, in many places four or five trees being found on a square foot. In other places, however, especially where the leaves were thick, they were rather scarce. But over the whole ground they were probably sufficiently numer-

ous to make an evergreen forest if they all continue to grow.

In August of this year the groves were again examined. The little spruces were still alive, and seemed to be about as numerous as they were last year.

It is too early yet to form a judgment as to the ultimate success of the experiment. Moreover, the results from a single experiment, however encouraging, are not sufficient to warrant the conclusion that spruce forests can be produced satisfactorily in this way. Repeated experiments are necessary, and with these we shall probably learn that the seed must at least reach the mineral soil.

The evergreens in poplar groves are, as far as my own observations have extended, mostly balsam, a species much less exacting in its requirements for reproduction than the spruce.

DRILLING TO BED ROCK

Description of an Important Class of Work in the Building of Irrigation Enterprises.

ONE of the least understood, but by no means the least important feature involved in the construction of a large irrigation project, is the work of drilling parties making underground investigations to determine the character of the formations upon which dams and other structures are to be erected. While the use of the drill is of the utmost importance in determining the location of dams, it is also essential in ascertaining the character of soil in reservoirs, in tunnel and canal construction, and in sinking wells. Without a knowledge of the depth to bed rock and the nature of the formation, no contractor would bid upon the work. It is not safe to rely upon surface indications, and even an experienced geologist finds himself at fault when endeavoring to predict the character of river bed for-

mations. In each of the great national projects this work is necessarily preliminary to actual construction, and frequently upon the results of the boring rests the feasibility of the project itself.

The drill outfit is of two kinds, one operated by steam power, the other by hand. The latter is used in regions remote from transportation and where fuel is not obtainable. As the reservoir and dam sites are usually located in inaccessible mountain canyons, far from railroads, the hand drill is generally used in connection with reconnaissance surveys and preliminary studies of the project, as it can be packed on the backs of horses and transported over mountain trails or lowered into deep canyons.

The drill consists of a steel bit screwed on the end of a hollow tube.

The drill chops down through the soil and loose material, which are forced upward in the casing by passing a stream of water through the tube. The casing follows the bit as it penetrates downward. On encountering a boulder or other material which retards the passage of the casing, the rod and casing are lifted, a charge of dynamite is set off and the obstacle removed. When rock is met with, a circular bit is used in which are inserted six or eight black diamonds or carbons. The rotary motion of the bit grinds the rock and the core comes up through the bit into the barrel to which the latter is fastened. On the bottom of the barrel just above the bit is what is called the core shell, with a split ring in it, both shell and ring being cone shaped. On pulling out the bit the ring slips down and closes, thus preventing the core from falling out.

Samples of earth are kept in four ounce bottles, the same dimensions as the diameter of core, and all are placed in trays properly labeled for the inspection of contractors bidding on the work. Each boring shows a complete section of the bottom. With this process one man made thirty-two moves of machine and put in 1,160 feet of boring in six days. The cost of the work varies from 10 cents to \$5 per foot, depending on the locality and character of material.

Notable instances of the unreliability of surface indications are numerous. A few of these may be mentioned as of particular interest in indicating how little dependence may be placed upon surface showings in river canyons.

In the Shoshone canyon, Wyoming, the river has cut a narrow passage with walls a thousand feet high, through a mountain of granite. Surface indications were that the river passed over bed rock and that no trouble would be experienced in fixing a

monster dam immovably upon the solidest sort of a foundation. But the drill quickly dissipated this hope. It took all winter to find bed rock, and it was only after a number of moves up and down stream that a suitable location was found. Here bed rock was found at 65 feet, after passing through boulders 30 feet in diameter on top of beds of gravel. At the point first selected for a site, bed rock was found at a depth of 88 feet, and borings were continued to a much greater depth to make sure that a solid foundation had at last been reached. At the Pathfinder dam site in Wyoming, where the surface conditions were practically identical, bed rock was found at a depth of 5 feet.

On the Colorado River between Yuma and the mouth of the Grand Canyon, the government expended \$40,000 on drilling and then failed to find a permanent base for a dam. At the Laguna dam site, near Yuma, the river passes between granite walls, and in the channel rocky ledges extrude in several places. The drill showed that these ledges were not connected at the bottom; that between them were great wide pockets of sand 168 feet in depth. This condition necessitated complete change of plans for a structure.

The engineers have completed preliminary borings in the Klamath country, southern Oregon, finding good formation near the surface for a dam site. Borings were made there for a tunnel 110 feet below the surface and 1,500 feet long, which is to take water around and outside the town.

At the Malheur dam site bed rock was found at 28 feet in a first-class location. At Minidoka, Idaho, the river cuts through a lava ridge and permanent foundation was found at 20 feet. Work is now being carried on by drilling parties in North Dakota, Oklahoma, California, Utah, New Mexico, Colorado, Montana, and Oregon.



THE PECOS VALLEY

Immense Development Going on and More
Promised Through Reclamation Projects

BY

A. M. HOVE

PECOS VALLEY, famed in song and story, is meriting fame in material progress as well. On all sides the visitor sees marked evidence of progress and development from Roswell southward far into the Texas part of the valley.

Irrigation in the upper Valley is by artesian wells or canals from tributaries of Pecos River, while in the lower valley the waters of the Pecos itself are used exclusively. Near Lakewood is McMillan reservoir, an artificial lake of large dimensions, supplying water to the fertile lands around Carlsbad, Otis, Loving, and Malaga.

Carlsbad itself is a beauty spot. Its convenience of location, its banking and trading facilities, its exceptionally good schools, its fine water and excellent supply of corn, alfalfa and other feedstuffs have attracted the stockmen from far and near. They live in Carlsbad and run their stuff, may be, a hundred miles away on the plains.

The superb climate, both summer and winter, the moderate elevation, 3100 feet, and good hotel accommodations make Carlsbad the Mecca of the health seeker and the pleasure seeker.

Carlsbad has risen to the occasion and the remarkable progress of the past year is proof thereof. Substantial business blocks and fine residences have gone up. Streets have been graded; sidewalks, as broad and smooth as any city can boast of, have gone in. Carlsbad is no longer a

jumping off place just beyond nowhere. It is modern, metropolitan.

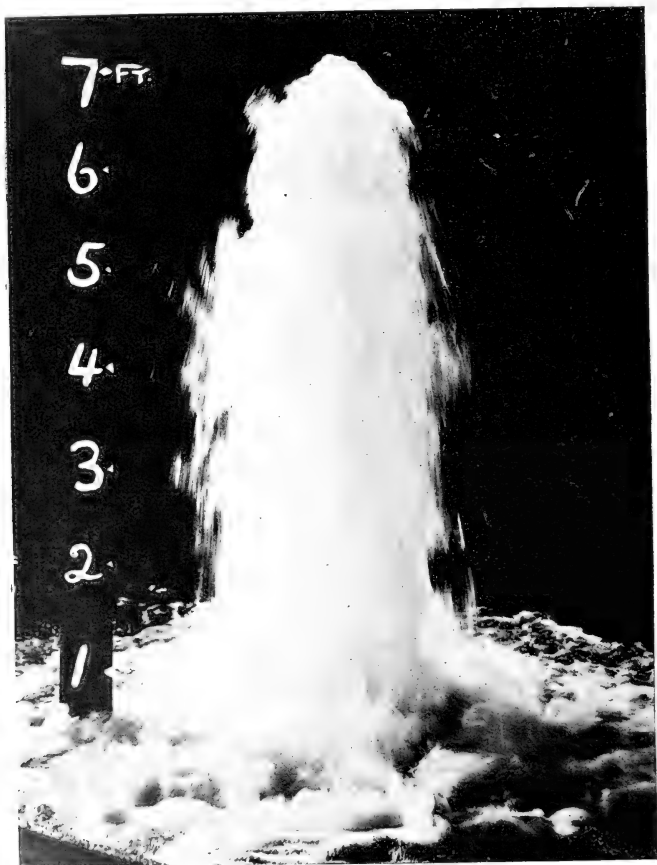
The farming section extends for many miles below Carlsbad. The soil is fertile. It responds to modern methods of cultivation like few soils. Strong in the elements necessary for plant food, all it needs is the directing hand of intelligent man to produce bounteous harvest of alfalfa, corn, fruit—anything that fancy may like to plant suitable to the climate.

This part of the valley is at present receiving more than its share of attention from men who look into conditions to determine what the future may be. The Reclamation Service has had a corps of engineers in the field since last December looking into the possibilities of a better and larger irrigation system under government control. B. M. Hall, Supervising Engineer of New Mexico, Oklahoma, and West Texas, with headquarters at Carlsbad, is directing the investigations. Thomas Means, soils expert, has gone over the lands and determined the acreage of land suitable for irrigation. H. A. Storrs, electrical engineer, has made an estimate of the probable amount of power that may be developed at the various dams. J. M. Giles, district hydrographer of the Geological Survey for New Mexico, Oklahoma, and West Texas, also has his headquarters in Carlsbad. Besides his regular assistant hydrographers other men connected with the hydrographic work like C. E. Murphy, Hydrographic Inspector, and M. O. Leighton, Engineer Hydro-Economic

Investigations, have also spent some time on the Pecos and more especially on the Carlsbad project.

The farmers have organized Water Users' Association to deal with the

have followed developments have come and bought lands so as to be on to go further and bring thousands of acres of desert under cultivation that private capital could not master.



View of the Largest Artesian Well in the Pecos Valley, near Artesia, New Mexico.
It flows over 3,000 gallons a minute

government in case the present investigations of the irrigation system of the Pecos Irrigation Co. and possible extensions result favorably. Everything so far looks promising, and men who

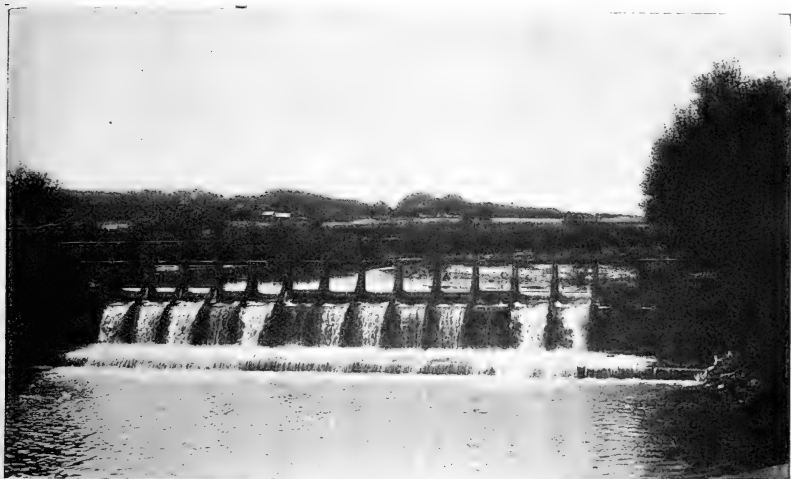
Two power dams are also under construction, one at Carlsbad and the other six miles south of Carlsbad. Both concerns will develop power for light and other purposes. It is prob-

able that electric power will come into use on the farms instead of gasoline and steam engines.

On the whole the lower valley is a the ground in time for the possible change.

Private capital has done much to

develop irrigation in this valley. But the Reclamation Service will be able good place to live. The farming district has free rural delivery, telephone system, railway stations near at hand—in short, all the conveniences that older communities claim.



Head of the Canal of the Felix Irrigation Company, in the Pecos River Valley, near Roswell

FORESTRY IN THE PUBLIC SCHOOLS

Suggestion As to a Way to Interest Children
in the Practical Side of Forest Growth

BY

A. NEILSON

SOME instruction in forestry, I believe, would be of great benefit to the children in our public schools, without working any great hardship on the teachers. I am painfully aware that a lot of hands will be raised in holy horror at the idea of introducing a new study, and I would not wonder at it, for in the present day, *real* work-

ers are, as a rule, overworked. But I think it very important to teach children something about nature in a practical way—and, in my opinion, the best thing to do is to teach them something about practical forestry.

The average child in the country grows up with the impression that country and nature simply mean dust,

WATER POWERS OF WISCONSIN

AN investigation of the stream flow and power possibilities of the State of Wisconsin has been in progress by the Hydrographic Branch of the Geological Survey for several years. Prof. L. S. Smith, of the University of Wisconsin, also has been making a study of this subject and recently prepared a report which is to be published by the U. S. Geological Survey in the form of a Water Supply and Irrigation paper. This paper will be full of facts concerning the water power resources of Wisconsin which will be of great benefit to the public in general as well as the people of Wisconsin.

The conditions for the creation of water power on the streams draining northern Wisconsin are among the best in the United States. In the northern-central part of the state there is a high plateau consisting of hard crystalline Pre-Cambrian rocks. This elevation is covered with a layer of drift deeply pitted by glacial action, which has resulted in the formation of numerous lakes throughout the entire region. These lakes form natural and extensive storage reservoirs for the rivers flowing from this plateau. The height of this land surface above all of the surrounding country results in a considerable excess of precipitation over its area, the actual rainfall here being several inches more than that of the surrounding country.

This region has an almost complete forest covering which adds greatly to the conservation of its water supply. Completely surrounding this Pre-Cambrian region is one of Paleozoic origin consisting to a large degree of soft Potsdam sandstone. Owing to the altitude of deposition and the poor weathering qualities of these paleozoic rocks, the country surrounding this plateau is considerable lower. Consequently the rivers that rise in this Pre-Cambrian district must necessarily pass from a high altitude to a low one,

and in so doing have cut their channels through the glacial drift down to the crystalline rocks.

In making this descent many rapids and vertical falls are produced, and throughout almost the entire course in making this passage from one character of geological formation to the other, excellent sites for dams abound. The most important rivers in the state of Wisconsin rise in this high region, either by actual source or by tributary. The Menominee, the Fox, the Wisconsin, the Chippewa and the St. Croix all drain waters from this region.

Menominee River, which forms the boundary line between Wisconsin and the upper peninsula of Michigan, is supplied by waters in the lakes from the Pre-Cambrian district of Wisconsin and the northern peninsula of Michigan, and passes in its course down from high altitudes to lower ones, and eventually into Green Bay. From the origin of this river at the junction of Brule and Michigamme Rivers to its mouth, a distance of about 104 miles, the river falls nearly 700 feet. This fall is concentrated into 15 rapids, any one of which is worthy of power development. These falls vary from 5 to 62 feet, the average of which is about 28 feet. At all of these locations there are reasonably good situations for dams. Of the 15 rapids 10 are still undeveloped.

In Wisconsin River between Ne-koosa and Rhinelander, a distance of 146 miles, there is said to be a fall of 640 feet, which gives an average fall of 4.43 feet per mile. This fall is concentrated into many rapids and vertical falls, producing a very large number of valuable water powers. Many of these have already been improved and are now the centers of important industries. There are many very valuable locations that have not yet been developed, especially in the upper reaches of the river. Between Ne-

koosa and Rhinelander there are nine excellent water powers with good locations for dam sites that have not yet been developed. The fall of these rapids vary from 20 to 90.5 feet, with an approximate average of 31 feet for the nine.

Black River, between a point near Neillsville and Black River Falls, a distance of about 40 miles, has a total fall of 337 feet, a fall of about 9 feet per mile. This fall is concentrated into rapids where heads from 24 to 85 feet can be developed.

On the Chippewa River, and its main tributary, the Flambeau, are likewise many excellent opportunities for power development. There are 15 well known locations above Eau Claire, none of which have been utilized. These rapids and falls vary in developable heads from 14 to 55 feet, the average for the 15 sites being about 31 feet.

Sufficient information concerning the St. Croix River profile has been acquired to make it certain that it has many very valuable water power sites. The St. Croix Rapids at Taylor's Falls contain 55 feet fall in six miles,

nearly all of which can be economically developed. There are several other well known rapids above this point that will eventually be developed as the surrounding country is better settled.

The mean and minimum discharge of these streams is so large as to insure a reliable water supply at the various rapids mentioned. For the past three years the U. S. Geological Survey has been doing systematic work in the line of gaging of these streams and their tributaries, and a considerable extension of this work will be made this summer.

The many tributaries of these streams abound more copiously in falls and rapids than do their parent rivers. A like condition prevails on the short and less pretentious streams of the Lake Superior drainage. Not only are the lower sites greater in number on these minor streams, but greater in height and fall. While the discharges are comparatively small, they are fairly constant. These conditions offer an excellent and reliable opportunity for investments of small capitalization.

RECENT PUBLICATIONS

Bulletin of the Iowa State College of Agriculture and the Mechanic Arts. Compendium Number, December, 1904. Vol. III—No. 1. Ames, Iowa, 1904. Pp. 80.

Of a high typographical standard, and with numerous excellent half-tone illustrations and interesting reading matter, this Bulletin of the Iowa State College of Agriculture and the Mechanic Arts certainly should serve to attract students, and further than a mere catalogue of the school, presents in an attractive manner the diversified charms of campus, dormitory, lecture room, foundry, machine shop, and college activities.

Johnson's Guide to the Government Land of the United States. Wm. H. Johnson publisher, Springfield Mo. Pp. 152, illustrated. 1905.

This volume was published with an idea of giving the best possible information concerning the public lands—where entries may be made, character of land, how to make entries, and with synopses of homestead,

desert, timber, mining and irrigation laws. The book has two grand divisions: First, "The Land," in which is described by states, all land open to entry; and, second, "The Law," in which all legislation, national or state, is discussed, also by states. To the homeseeker the volume should prove a boon, and the information given is substantially correct. Numerous half-tone illustrations embellish the book and amplify upon the reading matter.

Arid Farming in Utah. First Report of the State Experimental Arid Farms. Bulletin No. 91, Experiment Station of the Agricultural College of Utah. Pp. 113, illustrated. Logan, Utah, January, 1905.

Discussion of the subject matter in this bulletin is grouped under the general heads of general introduction; reasons for believing arid farming feasible; results already secured; work yet to be done, and principles of arid farming. There are nearly 45,000,000 acres of arid lands in Utah, and the Bulletin

discusses in a way interesting and intelligible to all, the best methods of reclaiming the land, and of the principles of arid farming.

First Biennial Report of the State Engineer of North Dakota. By E. F. CHANDLER. Pp. 91, illustrated. Tribune Press, Bismarck, 1904.

Some valuable information for irrigation farmers and water users generally is contained in this first biennial report of the State Engineer of North Dakota. The article on stream measurement and run-off of streams in North Dakota is especially interesting, and the description of the different apparatus used clear and lucid.

Forest Utilization. By Dr. C. A. Schenck. Pp. 118. Biltmore Forest School.

The matter contained in this pamphlet was prepared primarily for the students of the Biltmore Forest School, and is designed as an outline for study of this subject. There is no direct reading matter, except where such is necessary to make more clear some particular topic, and the whole is an outline subdivided again and again, down to the most insignificant process of utilization of wood or manufacture of by-products. That which is especially commendatory in the book is the fact that it presents in a lucid and concise manner the degree of relationship which all operations bear to each other, and their dependency upon certain conditions and the effect of certain causes.

Report of the Examination of a Forest Tract in Western North Carolina. Bulletin No. 60, Bureau of Forestry. By Franklin W. Reed. Pp. 29, illustrated. Washington, Government Printing office, 1905.

This one of the series of Bulletins issued by the Bureau of Forestry, which, while treating of a particular locality, is interesting to the public at large as affording an insight into the working methods of the Bureau, and giving them an opportunity of taking advantage, in whole or in part, of certain of the recommendations. The region described is an area of about 16,000 acres, in the counties of Mitchell, Caldwell, and Watuga, of which about 93 per cent. is still in practically virgin forest.

Report of the Superintendent of Forestry, Department of the Interior, Dominion of Canada. Pp. 28, illustrated. Ottawa, Government Printing Office, 1905.

A steadily increasing interest and appreciation of forestry by the people of Canada and a recognition of its value as a national asset, have done much to aid Mr. E. Stewart, Superintendent of Forestry, and make possible the splendid progress achieved in this branch of the service. An interesting

paragraph in the report deals with the co-operation extended by the government to prairie settlers in the planting of forest trees. In 1904 the total number of applicants for trees furnished by the government was 2,218, as against 1,649 in 1903, and the total number of trees distributed 1,800,000, as against 917,950 in 1903. The figures given show eloquently the acceptance by the settlers of the value and importance of trees.

Range Management in the State of Washington, Bulletin No. 15, Bureau of Plant Industry, Department of Agriculture. By J. S. Cotton. Pp. 26, illustrated. Washington, Government Printing Office, 1905.

This bulletin is a valuable contribution to our knowledge of improvement of range lands, and the study of the question was the result of a cooperative arrangement entered into between the Department of Agriculture and the Agricultural Experiment Station of Washington in the spring of 1901. This cooperative arrangement was concluded in December, 1903, and again taken up by the Department of Agriculture alone in June, 1904, and carried on since that date. The management of the range in a practical manner, calculated to make it serve all needs best and yet remain permanent, is a very serious problem in grazing sections, and this bulletin is therefore particularly appropriate at this time, when appreciation of this fact is gaining ground.

Indian Forester for February, 1905. Mr. E. P. Stebbins, editor. Pp. 60-117, illustrated. Allahabad, India, The Pioneer Press, 1905.

In January, 1905, the *Indian Forester* commenced its thirty-first volume with many improvements and additions. The size of the magazine has been made larger, it is printed on better paper than heretofore, and although it will be hard for the management to improve on the excellent reading matter which has always heretofore appeared in its pages, they have made its appearance more inviting by numerous illustrations in character, prints the governmental trations. The *Indian Forester* is semi-assignments of foresters, reports and matter of interest generally and this governmental association makes its readers confident of receiving authentic and authoritative information. The magazine, while devoting space to the discussion of professional problems which confront the Forest Service in India, also endeavors to lay before its readers both sides of questions when forestry comes into apparent antagonism with agriculture and the daily wants, habits and customs of the people, with irrigation projects, and in fact with the thousand and one difficulties which face officials of all classes in the performance of their work in the country.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., August 2, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Montrose, Colo., until 3 o'clock p. m., September 26, 1905, for the completion of the Gunnison Tunnel, involving 27,500 linear feet, more or less, of tunnel, the same being a portion of a system for the diversion of about 1,300 cubic feet of water per second from Gunnison River to the Uncompaghe Valley, Colo. Specifications, form of proposal, and plans may be obtained from the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., or from the Engineer of the Reclamation Service, Montrose, Colo.

THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, United States Geological Survey, Reclamation Service, Washington, D. C., August 22, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Roswell, N. M., until 2 o'clock p. m., October 17, 1905, for the construction and completion of earth embankments, involving about 200,000 cubic yards of earthwork and 150,000 cubic yards of overhaul, at a point about 12 miles southwest of Roswell, New Mexico. Plans, specifications and forms of proposal may be obtained by application to the Chief Engineer of the Reclamation Service, Washington, D. C., or to W. M. Reed, Roswell, New Mexico.

THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, Washington, D. C., September 1, 1905. Sealed proposals will be received at the office of the Supervising Engineer, United States Reclamation Service, 1108 Braly Building, Los Angeles, California, until 10 o'clock a. m., September 30, 1905, for furnishing from 30,000 to 40,000 barrels of Portland cement. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or to J. B. Lippincott, Supervising Engineer, 1108 Braly Building, Los Angeles, Cal., or to Homer Hamlin, Engineer, Yuma, Arizona. THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, Washington, D. C., September 7, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Billings, Montana, until 2 o'clock p. m., December 5, 1905, for the construction of the Lower Yellowstone Dam, a rock filled timber cribbed structure, requiring about one-half million feet of lumber, 700 piles, 1,600 sheet piles, 11,000 cubic yards of rock filling and riprap, and 100 tons of steel, located about 18 miles northeast of Glendive, Montana. Plans, specifications and proposal blanks may be obtained from the Chief Engineer, United States Reclamation Service, Washington, D. C., or from Frank E. Weymouth, Engineer, Glendive, Montana.

THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, Washington, D. C., September 16, 1905. Sealed proposals will be received at the office of the Electrical Engineer, United States Reclamation Service, 396 Pacific Electrical Building, Los Angeles, California, until 2 o'clock p. m., November 2, 1905, for furnishing complete, f. o. b. bidder's works, one or more 1,260-horse power water wheels and one or more 140-horse power water wheels, with gate valves, pipe connections, and governors, for use in Roosevelt power house, Salt River Project, Arizona. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, Washington, D. C., or to O. H. Ensign, Electrical Engineer, 398 Pacific Electrical Building, Los Angeles, Cal. THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, Washington, D. C., August 26, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Billings, Mont., until 10 o'clock a. m., September 26, 1905, for furnishing 25,000 barrels more or less, of Portland cement, f. o. b. cars at works of the bidder. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or to Jeremiah Ahern, Engineer, Cody, Wyo.

THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, Washington, D. C., August 30, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Belle Fourche, South Dakota, until 4 o'clock p. m., October 26, 1905, for the construction of an earthen dam and appurtenances, and $17\frac{1}{2}$ miles of canals, involving about 2,600,000 cubic yards of earthwork, 3,000 cubic yards of rock excavation, 24,000 cubic yards of concrete masonry and 45,000 pounds of steel and cast iron. The work is located about 12 miles northeasterly from Belle Fourche, South Dakota. Specifications and forms of proposal may be obtained from the Chief Engineer of the Reclamation Service, Washington, D. C., or from R. F. Walter, District Engineer, Belle Fourche, South Dakota. Plans may be inspected at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., or at the offices of the Reclamation Service, Chamber of Commerce Building, Denver Colorado, and Belle Fourche, So. Dak.

THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, Washington, D. C., September 9, 1905. Sealed proposals will be received at the office of the Electrical Engineer, United States Reclamation Service, 398 Pacific Electrical Building, Los Angeles, California, until 2 o'clock p. m., November 1, 1905, for furnishing complete, f. o. b. bidder's works, one or more alternating-current, 900-kilowatt, 25 cycle generators, one or more 100-kilowatt direct-current generators for exciter, and one switchboard containing one panel for generator and one panel for exciter, for use in the Roosevelt power house, Salt River Project, Arizona. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, Washington, D. C., or to O. H. Ensign, Electrical Engineer, 398 Pacific Electrical Building, Los Angeles, Cal.

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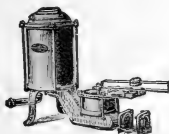
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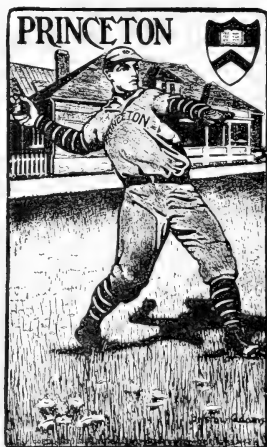
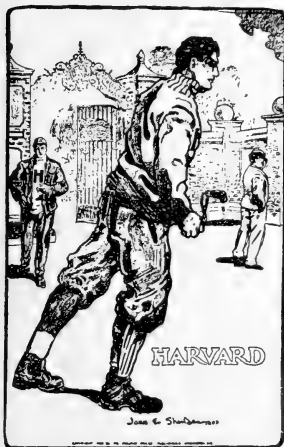
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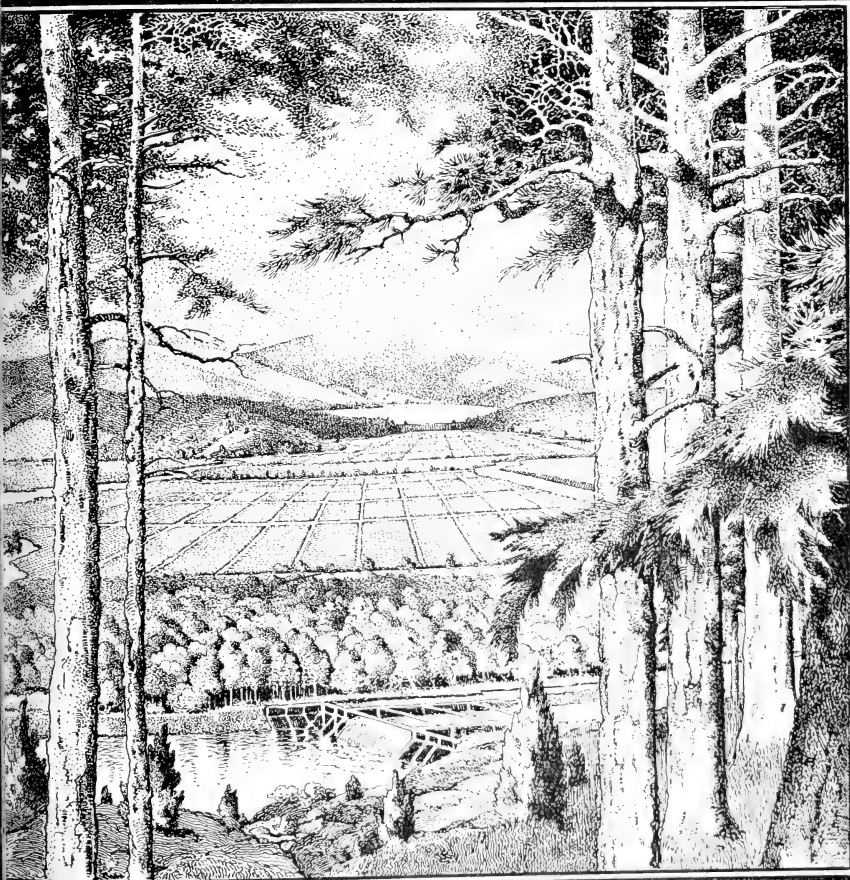
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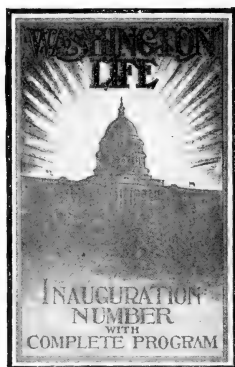
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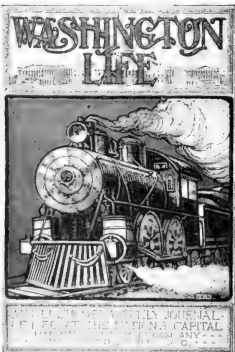
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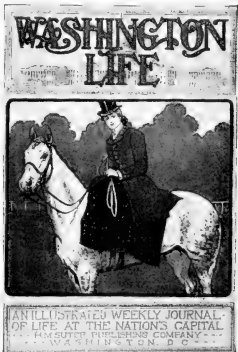


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Forestry and Irrigation

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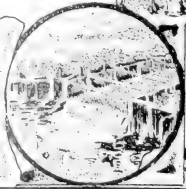
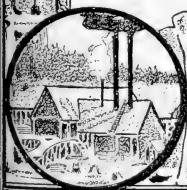
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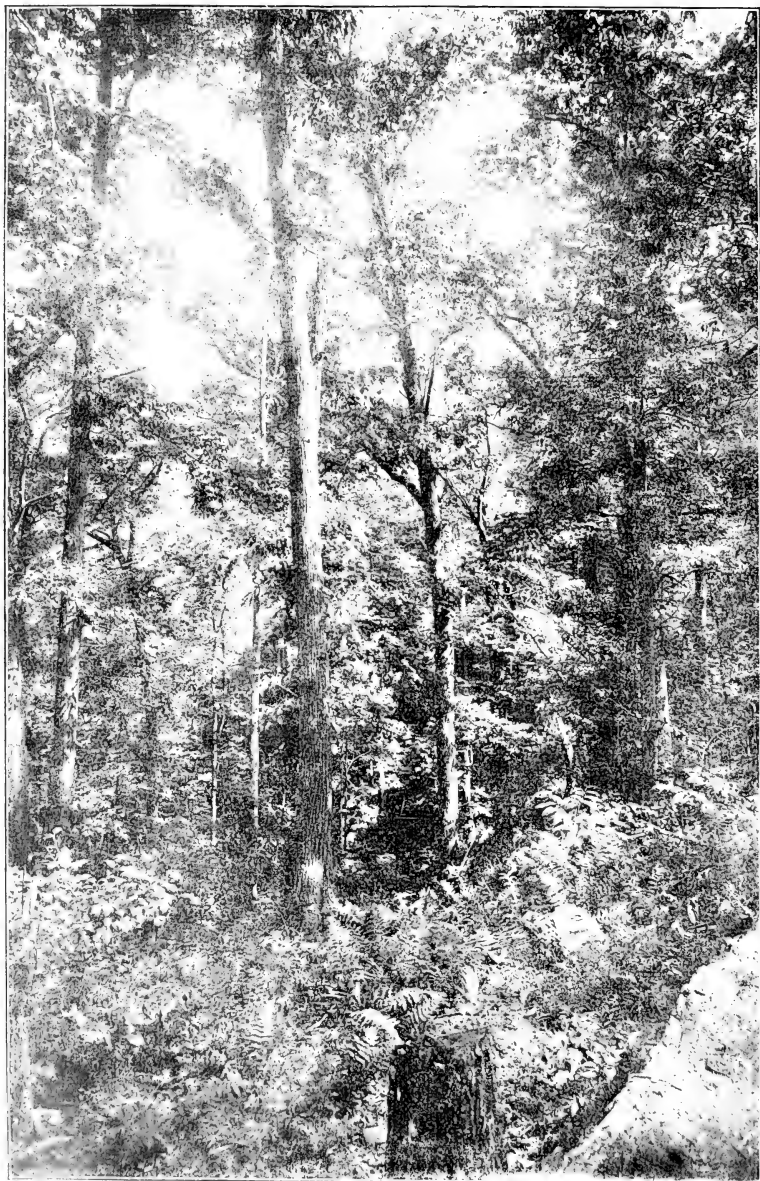
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Published Monthly at

WASHINGTON, D. C.





**FORESTS REGULATING THE FLOW OF STREAMS IN THE SOUTHERN AP-
PALACHIAN MOUNTAINS.**

The leaves and branches above break the force of the raindrops; the shrubs, ferns and humus below catch the water and pass it slowly downward into the soil and rock crevices; and from this great, natural reservoir, weeks or even months later, this water emerges in the numberless springs about the lower mountain slopes and feeds the rivers that cross

Forestry and Irrigation.

VOL. XI.

OCTOBER, 1905.

No. 10

NEWS AND NOTES

**President's
Notable
Stand**

In the course of his recent address at Raleigh, North Carolina, President Roosevelt made a notable reference to the importance of conservative treatment of our remaining forests. His statement that "If the Eastern States are wise, then from the Bay of Fundy to the Gulf we will see, within the next few years, a policy set on foot similar to that so fortunately carried out in the high Sierras of the west by the national government," should give impetus to the movement for national forest reserves in the east. It is a direct argument for the creation of a national forest reserve in the White Mountains and the Southern Appalachians—projects that are now enlisting the hearty co-operation of all friends of conservative forest management.

That section of President Roosevelt's Raleigh address devoted to forestry is printed in full elsewhere in this number, and deserves the careful reading of everyone. New England is becoming thoroughly aroused to the great need of preserving the forests of the White Mountains, and always public-spirited, it can be relied upon to support such measures in Congress as promise good to the country at large.

The South has not yet shown the measure of interest that this matter deserves, but with the progress of the present campaign for conservative forest management, and the awakening of southern business interests to the vital way in which they are affected by the forests of their region, is bound to bring support to the movement. It

will certainly be quickened by the President's strikingly practical utterance.

The Southern Appalachian and White Mountain Forest Reserves are projects that affect the national prosperity, and therefore should command the support of every patriotic citizen, regardless of section. President Roosevelt has wisely pointed the way, and early action should be the result.

**The
Minnesota
Reserve**

For some time a crowd of town-site speculators have been doing their utmost to have the Morris law, which created the Minnesota National Forest Reserve, repealed. In answer to this attack and for the impartial information of Minnesota people in general FORESTRY AND IRRIGATION prints in this issue a series of authoritative articles which should satisfy any fair-minded person that the Morris law should stand. Mr. Eugene S. Bruce has been in charge of the government forest work since the reserve was created, and his article sums up very clearly the purpose of the Morris law and the attitude of the Forest Service in administering it. He has had many years of experience as a practical lumberman, and having been on this reserve from its inception attaches unusual importance to his article.

Professor Samuel B. Green, widely known through his work in agriculture, and especially as head of the Experiment Station at St. Anthony Park, writes after a recent trip through the reserve, Mr. Chapman, from an intimate knowledge gained in Minnesota agricultural work, and as a member of the Forest Service, discusses

convincingly the question of the fitness of the reserve lands for farming. Mr. Charles Cristadoro contributes an interesting paper on the effect of forests on the Upper Mississippi River, a subject to which he has devoted much study.

The Morris Act Should Stand Mrs. Lydia Phillips Williams, chairman of the Forestry Committees of State and General Federation of Women's Clubs, and who has had a long and intimate acquaintance with the region embraced in the Minnesota National Forest Reserve, has the following to say about the repeal of the Morris act: "The Morris act? Why, all who are disinterested and know the facts want the Morris act to stand! It has proved a greater success than was even hoped for by the friends of forestry.

"The opposition comes from land speculators, 'long on town-sites.' The fact that the Indians receive under the Morris act more than five times as much for their timber as they ever before received ought to satisfy them, and the statement of Mr. Gifford Pinchot, and other foresters, that the 'seed is taking' and conditions are favorable

to the reproduction of the forest, satisfies the friends of forestry.

"These facts, together with the additional one, that the soil is non-agricultural, is sufficient to convince every fair-minded person that the best interests of all are conserved by the present law, and it should stand. If selfish motives could be 'run to earth' in this forest reserve agitation, Minnesota could furnish 'Frenzied Finance' an interesting chapter. The same agitators are back of this movement to repeal the Morris law that are anxious for the Winnibigoshish reservoirs to be abandoned. At the late public hearing the investigation freshet nearly overflowed these remarkable specimens of public benefactors and they 'took to the woods for cover.'

"Mr. Rehse, our artist, secured a good snapshot of them on the run. We readily recognize in the picture, the real estate firm which has fought the forest reserve. What noble specimens!!!

"If right sentiment prevails and 'graft' does not close the voice of the Minnesota press and choke the utterance of our congressmen the Morris law will stand."

Progress of Reclamation Work The work of the Reclamation Service in reclaiming the arid lands of the west is progressing rapidly. The acreage indicated as irrigable in the

following tables refers only to land to be benefited by the portion of the project first undertaken. Nearly every project is capable of extension so as to redeem many more thousand acres.

PROJECTS NOW UNDER CONSTRUCTION.

State.	Projects.	Amt. set aside for beginning construction.	Acres irrigable.
Arizona	Salt River	\$3,600,000	180,000
Cal. and Arizona	Yuma	3,000,000	85,000
Colorado	Uncompahgre	2,500,000	125,000
Idaho	Minidoka	1,300,000	60,000
Montana	Huntley	900,000	35,000
Mont. & N. D.	Ft. Buford	1,800,000	60,000
Neb. & Wyo.	North Platte	3,500,000	100,000
Nevada	Truckee-Carson	2,740,000	100,000
New Mexico	Hondo	280,000	10,000
S. Dakota	Belle Fourche	2,100,000	80,000
Wyoming	Shoshone	2,250,000	125,000



St. Paul Pioneer Press.

PORTRAIT OF DAM LAND SPECULATORS

Who Contend for the Repeal of the Morris Law Which Created the Minnesota Forest Reserve.

The total sum set aside for these projects is \$32,870,000, and the amount of land to be irrigated is 1,859,000 acres.

The average value of irrigated land in the United States is \$47 per acre. This acreage therefore will add \$87,373,000 to the taxable property of the

United States in land values alone. According to the census report of 1900 the average annual income from irrigated land is \$15 per acre. On this basis an income of \$27,885,000 per annum will be added to the nation's wealth by the projects already approved.

PROJECTS APPROVED BY THE SECRETARY OF THE INTERIOR.

State.	Projects.	Amt. set aside for beginning construction.	Acres irrigable.
Ore. & Cal.	Klamath Falls ...	\$1,000,000	236,000
Oregon	Malheur	2,250,000	100,000
Montana	Milk River	1,000,000	200,000
N. Dakota	{Bismarck		15,000}
Pumping	{Buford-Trenton .	550,000	18,000}
*Washington	Palouse	2,800,000	80,000
Idaho	Payette-Boise	1,300,000	250,000

*Secretary of Interior approved p
Board of Consulting Engineers post
upon.

roject, but at a subsequent meeting of
ponement of construction was decided

**Effect of
Copper
on Germs**

The authoritative announcements which have appeared in the daily news and scientific journals during the past year concerning the efficiency of copper in the destruction of germs of disease, have led to many interesting speculations, some of which have been altogether promising. Among these was one which occurred in connection with the employment of field men, geologists and engineers, in the U. S. Geological Survey.

It is well known that men performing field work are obliged frequently to resort to supplies of water which, even if they are not absolutely polluted with the germs of some disease, appear suspicious, and the field man is frequently in a state of indecision concerning the water with which he is provided in camp.

It was recognized that if copper possessed all the germicidal properties attributed to it, the question of water for soldiers, as well as for engineers and field parties, would be solved if canteens were constructed of this material.

Accordingly a supply of canteens were procured through the office of the Quartermaster, U. S. Army, and subjected to a series of tests. The work was performed at the Laboratory of Chemical Research connected with the Massachusetts Institute of Technology, by Mr. Earle B. Phelps, hydrographic aid. Mr. Phelps was provided with samples of water from various streams in all parts of the country, the idea being to thoroughly investigate the effects of waters of various characters, such as occur in different sections of the United States.

After an extended investigation covering a period of several months, it was found that while there is undoubtedly some small degree of germicidal property in the copper canteen, it is not sufficiently marked to be of value, and certainly not to be depended upon to render safe and pure such polluted waters as may be encountered by field and army men. Even the slight germicidal property which appears when the canteen is new gradually disappears, and in the end there appears to be no difference between the effect of

the canteen made of copper and the ordinary one constructed of tin.

The investigation is of extreme importance, inasmuch as the announcements concerning the absolute germicidal property of copper led to overconfidence, and might have resulted in considerable injury in such cases.

Reclamation Funds for Year Estimated amounts to be covered into the Treasury to the credit of the reclamation fund from the sale of public lands, and fees and commissions in the several states and territories during the fiscal year 1905, under the provisions of the act of Congress approved June 17, 1902, is as follows:

Arizona	\$47,449.52
California	361,557.87
Colorado	270,060.25
Idaho	370,272.90
Kansas	30,478.36
Montana	350,031.30
Nebraska	120,786.59
Nevada	12,157.93
New Mexico	85,602.58
North Dakota	870,290.01
Oklahoma	572,633.54
Oregon	675,325.60
South Dakota	174,448.96
Utah	50,716.82
Washington	522,203.50
Wyoming	243,962.94

Total\$4,757,978.87

Reclamation Fund Prior to June, 1904 It is also interesting to note the amount of the reclamation fund prior to June 30, 1904, which was at that time, as given in the following table:

Arizona	\$193,399.73
California	1,824,569.32
Colorado	1,651,187.75
Idaho	1,651,477.78
Kansas	109,450.78
Montana	1,797,157.70
Nebraska	492,713.47
Nevada	53,761.42
New Mexico	388,105.73
North Dakota	3,632,799.46
Oklahoma	2,637,073.59
Oregon	4,156,582.95
South Dakota	805,483.79

Utah	284,413.58
Washington	2,599,659.65
Wyoming	990,755.93

Total\$23,270,592.63

Drawback to Irrigation Work One of the principal officers of the Reclamation Service, who has recently returned from the west, said in an interview that the chief obstacle to rapid progress in the semi-arid portion of the country arises out of the essential requirement of the Reclamation Act that water shall not be supplied by the government to more than 160 acres in the hands of any one land owner.

Practically all of the land which may be reclaimed by government works in North Dakota, Oklahoma, and Washington is now in private ownership. The opportunities of reclamation are limited—probably not to exceed 1 per cent of the area of these states can ever be irrigated to advantage. This one per cent being now in the hands of individuals or corporations, it results that these persons have practically a monopoly of irrigable land. The government cannot carry out the terms of the Reclamation Act without the consent and active co-operation of these monopolists.

They appreciate this position, and believing that the government must spend its funds on these particular tracts, they are holding out for the very best terms obtainable. The values of these reclaimable lands have increased enormously; but not content with this, the owners are trying to force the government to most liberal concessions. On the one hand public clamor is being stimulated to immediately spend the reclamation fund without waiting for necessary safeguards; and on the other hand the men who own the land are standing out stiffly for privileges which are not thought of in the truly arid parts of the United States.

In other words, the people in the most arid part of the country, as in Arizona and Nevada, are more than

content to have their lands reclaimed by the government under any condition which may be deemed wise. Water is vital to them, and they only ask to be supplied with water, and leave to the government the terms, knowing that these will be small in accordance with law and in an equitable manner, without profit or interest.

On the other hand, the people in the less arid part of the country who are now owning the irrigable lands do not, as a rule, want these irrigated. The tradesmen in the towns and local statesmen are exceedingly eager to see the government spend its money and are indifferent as to how it is spent. They are the ones who are urging immediate construction of irrigation works.

The men who own the land to be irrigated do not display anything like this eagerness. Many of them state frankly that they will not irrigate; that they do not want the water; that for the last year or two they have had good crops, and do not wish to be bothered with the necessary change in form of agriculture. More than this they prefer to cultivate on a large scale—several hundred acres—rather than confine themselves by intensive farming to 40 or 80 acres. They have always been accustomed to the use of machinery and cannot for a moment admit that they will ever be content to go back to the careful and thorough irrigation and cultivation of what seems to them mere kitchen gardens.

The owners of these lands are perfectly willing that the government should put in irrigating plants, build the ditches, and be in a position to supply them with water if they should ever want it; but they absolutely refuse to bind themselves to use this water or pay for it, unless in the future they might wish to use it on a small area. In other words, they would like to see the money spent in their vicinity; would like to be in a position to enjoy the benefits of such expenditure, provided they are not put to any inconvenience, or called upon to pay for

the improvements unless they so desire.

Conditions on Colorado River

A prominent civil engineer visiting the west writes that the conditions on the lower Colorado River are steadily growing worse. Some years ago a Mexican corporation diverted the river on its right bank in Mexican territory. A part of the waters was conducted westerly and finally flowed into a depression known as the Salton Sink, this being in southern California adjacent to Mexico. The sink and surrounding desert land extend down to nearly 300 feet below sea level.

During the past year the Colorado River has gradually enlarged the temporary opening and has eaten into the bed and bottom of the artificial channel until now nearly the entire volume of the stream rushes down a relatively steep slope into this great depression. The water accumulating in the basin is slowly rising and has already inundated settlements and has forced the abandonment of many miles of the Southern Pacific track, the road being forced to build temporary tracks around the rising sea.

The river at the point where it escapes has now cut its bed down nearly 9 feet below the usual level and the ancient channel of the river is being eaten backwards up toward Yuma, so that the canals which formerly took water upon the irrigable lands near Yuma are left high and dry and the people are being forced to abandon their homes and farms. The condition is serious, and unless Uncle Sam takes a vigorous hand and politely but firmly requires that the river be restored to its old channel there will be great losses to American citizens, both in the vicinity of Yuma and in the Salton sink.

It may cost half a million of dollars to get the river back in its proper channel. The material through which it has cut its new channel is the very light soft mud which has been depos-

ited by overflows of the stream, and which in the rapid current melts away almost like sugar. Piles driven into it even a hundred feet in length are quickly loosened by the swirling rush and come bobbing to the surface in a short time after they are driven into

place. The eroding waters eat into the banks more rapidly than stone or willow mattress can be placed, and the builder sits hopeless as he sees the water rushing swiftly around or under or through his most ingeniously woven contrivances.

PRESIDENT ROOSEVELT URGES SOUTHERN APPALACHIAN RESERVE

**Strong Plea Made in Raleigh Address for
Conservative Handling of Southern Forests**

THAT the establishment of a national forest reserve in the southern Appalachian Mountains is a matter of national concern was dwelt upon with emphasis by President Roosevelt in his address at Raleigh, N. C., on October 20. He pointed out how vitally southern forests affect southern industries and thus the entire country. His remarks on this point follow in full:

"I want to say a word to you on a special subject in which all the country is concerned, but in which North Carolina has a special concern. The preservation of the forests is vital to the welfare of every country. China and the Mediterranean countries offer examples of the terrible effect of deforestation upon the physical geography, and therefore ultimately upon the national well-being of the nations. One of the most obvious duties which our generation owes to the generations that are to come after us is to preserve the existing forests. The prime difference between civilized and uncivilized peoples is that in civilized peoples each generation works not only for its own well-being, but for the well-being of the generations yet unborn, and if we permit the natural resources of this land to be destroyed so that we hand over to our children a heritage

diminished in value we thereby prove our unfitness to stand in the forefront of civilized peoples.

"One of the greatest of these heritages is our forest wealth. It is the upper altitudes of the forested mountains that are most valuable to the nation as a whole, especially because of their effects upon the water supply. Neither state or nation can afford to turn these mountains over to the unrestrained greed of those who would exploit them at the expense of the future. We cannot afford to wait longer before assuming control, in the interest of the public, of these forests; for if we do wait, the vested interests of private parties in them may become so strongly entrenched that it may be a most expensive task to oust them. If the Eastern States are wise, then from the Bay of Fundy to the Gulf we will see, within the next few years a policy set on foot similar to that so fortunately carried out in the high Sierras of the west by the national government. All the higher Appalachians should be reserved, either by the states or by the nation. I much prefer that they should be put under national control, but it is a mere truism to say that they will not be reserved either by the states or by the nation unless you people of the South show a strong interest therein.

"Such reserves would be a paying investment, not only in protection to many interests, but in dollars and cents to the government. The importance to the southern people of protecting the southern mountain forests is obvious. These forests are the best defense against the floods which, in the recent past, have, during a single twelfth-month, destroyed property officially valued at nearly twice what it would cost to buy the Southern Appalachian reserve.

"The maintenance of your southern water powers is not less important

than the prevention of floods, because if they are injured your manufacturing interests will suffer with them. The perpetuation of your forests, which have done so much for the South, should be one of the first objects of your public men. The two senators from North Carolina have taken an honorable part in this movement. But I do not think that the people of North Carolina, or of any other southern state, have quite grasped the importance of this movement to the commercial development and prosperity of the south."

SEEDING WASTE LANDS

The desire to secure a forest growth on the enormous areas of waste land in the west is very strong, but the extent of the actual planting is reduced by the prohibitive cost. Naturally the desire is to secure satisfactory forestation at the minimum expense. The most simple way of attaining this end is by broadcast sowing of seeds on the areas where trees are to stand, thus eliminating the expense of nursery production and transplanting. In certain regions adverse soil conditions and arid climate make such a method entirely impossible. On the other hand, in places where the mineral soil has been exposed by fire or otherwise, where the rains are sufficient and properly distributed, and where birds and rodents are not present in great numbers, such reproduction may be obtained by sowing the seeds.

The Forest Service has recently finished planting a series of experimental seed plots on the lands of the McCloud River Lumber Company near Mt. Shasta in northern California. The area selected was originally covered with an open stand of large yellow pine and a ground cover of dense chaparral. The removal of the timber and the burning of the chaparral left the ground bare and in excellent shape for a seed bed. The seeds planted were western yellow pine, and for experimental purposes part of them were

sown broadcast and others were dropped at regular distances apart in depressions made by the heel of the planter, and covered with the foot. This latter method is more rapid than would be supposed and was accomplished by a hitch step, which was termed "the forester's quick step."

Near the Fort Bayard Military Reservation in New Mexico similar experiments are being carried on with the Mexican walnut and native oaks. In this case the acorns and walnuts are planted along the streams where erosion has been so serious during the heavy rains of the past year. Both of these trees have a massive root system and are calculated to hold a stream in its bed and thrive in the arid climate of the region.

In the Black Hills of South Dakota broadcast sowing was done last spring on an old burn, and small areas were planted with a corn-planter. The present indications are that these experiments will be highly successful.

Forest stands secured by direct seed planting are less regular and less certain than where the trees are nursery-grown and set out when two or three years old. For the sake of economy, however, this method of direct seed sowing will be largely followed in future operations where conditions permit.

THE MINNESOTA NATIONAL FOREST RESERVE

BY

EUGENE S. BRUCE

Inspector, U. S. Forest Service

IN view of the many misleading statements that have been published with the express object of influencing public sentiment against the Minnesota National Forest Reserve, the following facts may interest those who want to know the real situation regarding this reserve and the steps taken in its formation.

The Morris amendment to the Nelson Bill provided that the Forester of the Department of Agriculture select 200,000 acres of land classified as "Pine land" from lists to be furnished him by the Secretary of the Interior from certain described ceded Indian lands. The classification of these Indian lands was to be made by the Interior Department, the forester having nothing to do with the classification.

In classifying the Indian lands only two kinds of land were allowed to be recognized—"Pine lands," those upon which there was merchantable pine timber, and "agricultural lands," which included all other lands, whether burns, barrens, muskegs, swamps, marshes, or boggy shores of lakes.

By the terms of the Morris Bill, 25,000 acres of lands classified as "agricultural" were to be included with the 200,000, which, at the time the act was passed, was thought would be amply sufficient to consolidate the area selected. The fact that there were only two kinds of land to be distinguished, accounts for the large area classified as "agricultural," the greater part of which is absolutely worthless for "agricultural" purposes.

At the time of the passage of the Morris Bill there were no maps available which showed the Indian allotments. "Agricultural" and "Pine

lands," in fact, a large portion of the Indian Reservations was not classified at the time, which explains why there was no way of knowing just how much land other than pine land would have to be included to consolidate the area selected.

The very apparent intention of the legislators was to allow a sufficient amount of lands classified as "agricultural" to be included to make the area selected for the Minnesota National Forest Reserve one solid, compact body. The system of classification, however, made it impossible to consolidate the area with only 25,000 acres of so-called "agricultural" land, the amount specified in the Morris Bill.

It has been charged that the selection of that portion of the Reserve in the vicinity of the village of Cass Lake was an injury to the inhabitants. The obvious reply is, that the most compact body of classified "pine lands" on the Reservation, and containing the lowest percentage of lands classed as "agricultural," is comprised in the townships which border on Cass Lake and those contiguous to them. Moreover, if these townships, which were almost entirely classified as "pine land" had been excluded, it would have been impossible for the forester to comply with the provisions of the Morris Bill, and select 200,000 acres of "Pine lands" in anything approaching a contiguous area or with any possibility of consolidating the Reserve in such form that it could be protected and administered properly and economically. The first selection for the Reserve contains the largest acreage of compact "Pine lands" and the smallest percentage of lands class-

ified as "agricultural" of any area of equal size which could have been selected in these Indian Reservations.

It has been stated that there are other locations on these Reservations which could as well have been selected which would have served the purpose of a Reserve just as well. The facts on the ground justify no such statement. Had it been possible to select the territory further north and east, which it was not, since the greater part of those lands were classified as "agricultural," the result would have been to protect the headwaters of the Big Fork River, a tributary of the Rainy River, which runs into a foreign country. This would not have served the purpose for which the Reserve was created, which is to protect the headwaters of the Mississippi River and grow timber tributary thereto.

A portion of the Reservation (delineated on present maps by a black line) was withdrawn April 23, 1903, from sale or settlement. This was done on the recommendation of the forester, who agreed to confine his selection for the Reserve within the black line, the Secretary of the Interior agreeing that none of the withdrawn area should be opened to sale or settlement until the territory to constitute the Reserve had been finally selected. This step was taken to allow lumbering to begin, pending the completion of the Indian allotments and the delineation of the War Department's flowage line, that Department having purchased from the Indians the right to flow certain lands inside these Reservations, prior to the passage of the Morris Bill.

The allotting of Indians inside the black line has not yet been fully concluded. Locations have been completed in the field, but these have not yet been finally acted upon by the Indian Department at Washington, nor have maps yet been received from the War Department showing the flowage line. But from a list which has been furnished by the War De-

partment showing lands which will be affected by the government dams located at Leech Lake and Winnibigoshish, it appears that 75 per cent. of the lands which were included within the black line, classified as "agricultural," are affected by the flowage and liable to be submerged.

The territory withdrawn includes approximately 207,000 acres of land classified as "Pine lands" and the smallest amount of lands classified as "agricultural," which it was possible to include, and, at the same time, include the requisite number of acres of land classified as "Pine lands."

The 7,000 acres of "Pine lands" within the black line in excess of the 200,000 acres stipulated in the Morris Bill, was included because a careful examination made it very apparent that a part of the classified "Pine lands" would be covered by the flowage and it was estimated that the surplus of "Pine lands" would be needed to replace the acreage which would be flooded. The lists received from the War Department show that the estimate was conservative.

It has been frequently asserted that these "Pine lands" are not really "Pine lands" but are good agricultural lands. Again, I call attention to the actual conditions existing on the ground. Any one who is acquainted with this region or any similar region knows whether land upon which Norway, white and jack pine grow naturally can justly be considered as highly valuable for agricultural purposes. It is of exactly such lands that the area selected for this Reserve is chiefly composed.

The selection was not entirely the work of one man. The area included was looked over by the forester, the Commissioner of the General Land Office, Gov. W. A. Richards, the Indian agent, Major Scott, and the writer, all of whom expressed themselves in favor of its location. Some of those who are now the foremost opponents of the Forest Reserve saw a

map of the proposed location before it was submitted to the Secretary of the Interior for his approval, and expressed themselves as highly pleased with it.

There is no reason why the location is not as desirable to-day as it was at the time it was made.

It was freely stated before lumbering operations commenced on this Reserve that the brush could not be piled and burned for less than \$2.00 per M. It has been demonstrated by the actual operations that it can be successfully and properly done for from fifteen to twenty-five cents per M., depending on the class of timber, density of the stand, and the executive ability of those in charge of the work.

The statements that this work is simply an experiment in forestry are also fallacious. Forest management along similar lines has been successfully conducted for years. The reproduction of young pine on the area selected is better than on any other portion of the Chippewa Reservations. This was a very necessary point to be considered, on account of the small percentage (5 per cent.) left for seed trees to insure reproduction.

In addition to the trees left for restocking, there are large areas throughout the Reserve where the ground is covered with a growth of young and thrifty pines from one to thirty years old.

The statement has been published that on the heavy timbered sections east of Cass Lake along the Great Northern Railway, the brush from lumbering would be six feet deep and that in order to burn it without destroying the whole country, it would be necessary to load it on flat cars and haul it out to the prairie country in Dakota. Instead of that being the case, the brush and debris on these densely timbered sections, the heaviest stand on the Reserve, has all been burned in accordance with the rules and regulations of the forester. Not one of the seed trees has been injured

by fire, and actual measurements show that less than 7 per cent. of the area lumbered was covered by the brush piles. On the territory lumbered during the winter logging season of 1904-1905, the actual area covered by brush piles which were burned has been found by actual measurement to be less than 2 per cent. of the total area logged.

The relationship between the lumbermen and the forestry officials has been friendly and amicable throughout. On all the territory lumbered to date, the brush piling and burning has been completed and not one fire originated beyond control nor has any of the young growth of seed trees left standing been injured.

The geographical location of this Reserve on the headwaters of the Mississippi River makes it possible for all timber which is removed whether now or in the future, to be cheaply floated down that stream to any city located upon it, from the Reserve to the Gulf of Mexico, free from injury by fire, worm or beetle the moment it is placed in the water, with the additional advantage that it can be stored or held in boom at any point along this great thoroughfare until such time as it is desired to manufacture it into lumber.

The forest conditions of this reserve render it one of the most natural pine growing areas in the United States, the strongest evidence on that point being the noted stand of timber which is at present being removed from it, and which was sold for the highest price ever paid for timber in the region.

Although this Reserve, compared with other Reserves, is small, yet from its particularly favorable location and its natural suitability for the growth of pine timber which can be so economically distributed to its markets, I question if double the area in any other Reserve will be of as much real benefit to the people of the United States as the small but highly important Minnesota National Forest Reserve.

A WHITE MOUNTAIN FOREST RESERVE

Its Immediate Need, and Its Relation
to the National Forest Reserve Policy

BY

EDWIN A. START

Secretary, The Massachusetts Forestry Association

THE question of a national forest reserve in the White Mountains is far broader than many who are not fully acquainted with the facts and conditions realize. It is not a question of saving for the state of New Hampshire some valuable property in which short-sighted officials have been squandering the state's birthright in past years. That this has been done is true, but it is no concern of ours. Other states have been short-sighted, penny-wise and pound foolish. The nation has been so more than once, but this is no argument against a policy that is good now, and that means continuing good for future years. The United States is fairly embarked on a forest reserve policy. This policy has had its years of bitter opposition in the west, and has emerged triumphant. We are organizing a capable forest service which is destined to put this country in the foremost place among the nations in forest management and utilization.

Now the question we of the northeast, and of the southeast, ask is whether or not all the benefits of this wise policy are to be confined to the country west of the Mississippi? There lie the great forests, but here in the older and more thickly settled states there still remain certain areas of immense value to many of the states, which should not be given over to private control, because that means wasteful lumbering that will put a few hundred thousands in the pockets of a few men to-day and result in a loss of millions to the country at large in

the next few years. Such a course is too unenlightened, too uneconomic to be considered by a powerful, practical nation, with ample means to maintain and defend its interests. We invest \$5,000,000 without the quiver of an eyelash, in a battleship that will be a continual charge upon the country and will be obsolete in ten years, and then we are met by the cry of poverty and economy when we ask that a like sum be expended to preserve under intelligent forest management for all time the forest region of the White Mountains. Yet this latter expenditure, instead of producing more expense, will give to the nation a piece of property that is worth the money to-day, the reservation of which will result in an immediate conservation of a part of the national wealth, and which will be increasingly productive from decade to decade.

The United States has at present an investment of \$200,000,000 in forest reserves west of the Mississippi. Is it asking too much that \$15,000,000 should be invested to save two valuable areas of the rapidly disappearing forests of the eastern states and to protect important inter-state water supplies?

It is sometimes said that New Hampshire should take care of the White Mountains, that New York has done so with much of the Adirondack country; but this plea is trivial. New York is the most populous and wealthy state in the Union, and the Adirondacks are solely a state possession. New Hampshire is a poor

state financially, and sparsely settled, and the White Mountains as a reservoir affect all New England, except Rhode Island. Manifestly this is a national proposition.

Furthermore as a breathing place for thousands, as a conservator of the people's health, as a playground, the White Mountains belong to no one state, but to many. Not in the length and breadth of the United States is there a region whose summer visitors come from so many parts of the country, from so many states. Love of

purpose which nature has marked out for them.

The restoration of forests in the path of clean cutting is necessarily slow, but on these granite hills it is often impossible. Ages ago the glacial movement overlaid these upheaved rocks with a thin soil in which the forest growth established itself and which it strengthened from year to year; but the cutting of the upper slopes exposes this soil and it is carried off in great slides, leaving bare rock on which nothing save another



Logs and Lumbered Land, North Woodstock, New Hampshire.

these hills went westward to New York and far beyond with the emigration from New England, and every year a great tide comes back from other states to enjoy them and to find among them the strength and pleasure that they have to give. Here among the older states these breathing places become fewer with each generation, but certain spots are protected by nature from over-civilization. These we need to save with care and to preserve everything about them that makes for the efficient accomplishment of the

glacial period can ever replace growing soil. The lumber companies are working farther up the high slopes and when the last protecting belt of timber goes, swift destruction follows it. To save for conservative forestry as much as possible of the old forest and to reforest the cut-over areas is the work to be done, and the national government and the national forest service are the agencies that must be looked to for these results.

Let the national reserve policy be made truly national. The system is

now lop-sided. Something is needed in the east to at least partially correct this condition. Two areas, one in the north and one in the south, are indicated for this purpose by every condition of forestal value, water conser-

vation, inter-state importance, and the loss to the national wealth under the present arrangements. Every year that is lost in doing what needs to be done simply increases the cost by loss in value of the property.



A Pine Forest on the Terraces of the Connecticut River, Purchased by Citizens of Hanover, to Save from Cutting.

CARE OF THE MINNESOTA NATIONAL FOREST RESERVE

BY

SAMUEL B. GREEN

Professor of Forestry, University of Minnesota

I HAVE recently returned from a short trip to the Minnesota National Forest Reserve, which I visited for the special purpose of noting how the Bureau of Forestry had managed the selection of lands and the logging operations there. I am much pleased with the progress thus far made, and believe that if the work is allowed to proceed along the lines laid down in the Morris law that the final results will prove a wonderful demonstration of the advantages of conservative lumbering.

There is a fine natural reproduction on this forest reserve, the most of which is under ten years old. The absence of anything older is probably due to severe fires. At the Goss camp about twelve million feet were cut last winter and the tops had been burned at the time of my visit. Five per cent of the trees were left standing to seed the land. These trees seem to be well rooted and they have stood the severe blows of this spring with very little—if any—loss from blow-downs, although high winds have accompanied very heavy and long continued rains. The tops were piled in good shape and burned, leaving only some of the larger top logs and heavy branches on the ground. Although the logging injured many seedlings, yet in most places where the land has been logged there are a sufficient number coming on to stock the land again in good shape. The cost of burning the tops has been from 10 to 15 cents per thousand feet cut.

This Reserve is situated in Northern Minnesota, about midway between Lake Superior and North Dakota. It is a junction point of the transconti-

ental system of the Great Northern Railway, and its line from St. Paul.

The Minnesota and International Railway, which is controlled by the Northern Pacific Railway, also enters the Reserve. It is about five hours' ride from Duluth and seven hours ride from St. Paul and Minneapolis.

This section of Minnesota is noted for the salubrity of its climate. It is here that the head waters of the Mississippi come together and from near this point the water flows north into Hudson's Bay, as well as through the Mississippi into the Gulf of Mexico. It has been a noted hunting ground for the Indians and the predecessors of the Indians, have here built many mounds.

The land is generally sandy throughout the larger part of the reservation and under present conditions it is very doubtful if there is any considerable area that can be used profitably for agriculture. Personally I have never seen any profitable agriculture carried on on similar land in Minnesota. The claim that the sandy soil of this section is peculiar in its power to produce crops must be very much discounted. This kind of land will produce crops if it is handled with the greatest care, but it must be heavily manured nearly every year to get any kind of a crop on it and even in the woods where the soil is exposed there is little or no growth of grass, pea vine or other forage crop as is so common over large areas of the better timber land of Northern Minnesota. No better evidence of the leachy character of the soil could be given to those familiar with such matters than a statement of the simple fact that at the time of my

late visit there, May 13th and 14th, when the roads were nearly impassable on the clay soils of Northern Minnesota, that although there had been recent heavy rains in this section the roads were perfectly dry and even dusty. In the vicinity of Cass Lake very little is done in the way of gardening, although high prices prevail for vegetables in the town and most of them are imported. Corn, melons and other vegetables can be raised here if the land is heavily manured, but not otherwise.

The lands of this section, including those in and about Cass and Leech Lakes, are best adapted and will prove most profitable when developed as a great summer resort. It has many advantages for a place of this kind, among which may be mentioned fine bathing beaches and the unexcelled lakes and streams for canoeing and steamboating. It is possible to start at Cass Lake and take in a water trip of over a hundred miles without entering the same water twice, and come back to within a few miles of the starting place. The dry soil and high bluff lands about the large lakes are particularly adapted as sites for hotels and cottages, which sites may be leased from the Government under the Morris law. The Morris law reserved the timber on the principal points and islands in Cass and Leech Lakes so that it will be retained in its primeval beauty. It also reserved ten sections of land, which were to be selected as might seem best. This selection has been made and consists of the lots about the larger lakes, which are thus surrounded by a wealth of primeval pine forest, the finest of its kind in America, from a few to forty rods in width. There is nothing more grand and beautiful on the earth than these clear lakes with their beautiful setting, and if the people of Minnesota permit their despoilment it will be to their everlasting shame.

The sportsmen of Minnesota have an interest in the retention of this area as a forest reserve, for it can be

made a breeding place for game and fish, and the United States Forest Service will gladly co-operate with them in carrying out such a plan.

It may be safely said that the only opposition to the Minnesota National Forest Reserve comes from the proprietors interested in the Cass Lake town site, who located here soon after it was proposed to develop a forest reserve in this section. This town has a population of 600 to 700 people. It is a division headquarters of the Great Northern Railway, and has also one large saw-mill. The town was plainly started for the purpose of furnishing supplies to loggers and to others who were outfitting for the woods, and to take advantage of the opportunities for doing business that would be afforded when the reservation was thrown open to settlement. But lumbermen have not taken kindly to outfitting here. In fact, under present conditions there is comparatively little outfitting done by lumbermen in the small towns, but most of their supplies are purchased in the larger cities. Hence, the complaint of the people of Cass Lake that logging on the Reserve has done them no good. This, however, might just as well have been the case under private ownership, as loggers can buy where they please. Some of them have apparently planned their enterprises so as to avoid paying their men off at Cass Lake, which is another ground of complaint. This, added to the fact that the whole reservation has not been thrown open to settlement as was expected, has led to considerable disappointment. The Indians are in favor of the forest reserve, for they are allowed to use it as heretofore, and yet they have also been paid for it and have received more for their timber which has been sold on this reservation than they have previously obtained for their timber and land together.

I have been told by what I believe reliable authority, that certain promoters of the Cass Lake town site see that this section is destined to become a popular summer resort and want a

chance to get possession of the beautiful shores of the lake for speculative purposes. I think these shores are destined to be used as sites for hundreds of summer cottages, and that thousands of people, not only from Minnesota cities and towns, but from all the larger cities of the Mississippi Valley, will here find rest and recreation. The Morris law will permit of such a use of these shores, and did it not I would favor an amendment for promoting it. With a suitable system of leasing cottage sites for this reservation, under the supervision of the Forest Service of the National Government, there can be built up the finest summer resort in the world. There can be no question but what if

those who are interested in the development of this section will ask the National Government to lay out a suitable system of roads and driveways through the reservation, the request will be granted and would do very much to hasten its development. It is more than probable that the Government would lay out roads in this section much as it has laid out roads in the Yellowstone National Park.

The present Cass Lake business ideals and methods are destined to disappear, but in their place will come a new Cass Lake with higher and better business ideals and methods, and a prosperity established on a sure foundation, compared with which the present progress will seem trite and weak.

PROTECTION OF WHITE MOUNTAIN FORESTS

BY

ALLEN CHAMBERLAIN

NEW England's sons and daughters, whether living at home or settled far and wide in other sections of our land, always think of Mt. Washington and the Presidential Range, with their flanking and encircling mountains, as being worthy to rank among the most superb gems of our national crown. They would not claim for the region the distinction of possessing the very finest natural beauty in the land, nor herald it as the largest "wonder of the age," but they do fondly believe, and with good right and reason, that there is a vast store of beauty and charm contained within those comparatively narrow limits. All this might be set down to a proper local pride, were it not for the fact that hundreds of people from other sections of the country, resort there summer after summer, and ardently endorse the native New Englander's praise of the White Mountains.

It is unnecessary to enlarge upon that topic of the economic value of natural beauty in the life of the nation, through its power to refresh and inspire men for the directly practical work of the world, for that is generally conceded to-day. But those mountains mean something more than tonic force to New England, and therefore to the nation of which she is a patriotic member. Located within the political boundaries of a single state of the group they nevertheless have their influence on the trade and commerce of all the neighboring commonwealths. The mountain forests have long been a principal source of lumber supply, and have guarded innumerable fountain heads which feed some of the most important water powers of the northeast.

For a time the lumberman was content to take only the mature timber from those mountains, and of that merely such as stood in the valleys and

on the easy lower slopes. During the past decade, however, with the timber supply of the country at large dwindling rapidly under the greatly increased demand for saw logs and pulp stock, the lumberman's policy has

changed and he has returned to the once culled forest and stripped out practically all that was left of the merchantable sorts. In the process of this wholesale cutting much of the uncommercial timber has been de-



Typical Destruction on the High Slopes Side of Mount Moosilauke.

stroyed, in many cases needlessly, or at best only made necessary by reason of the operations being pushed up the steep slopes, originally regarded as too inaccessible and costly to log over. In this way nearly all of the old virgin forest in the mountains has already disappeared, and the logging is being pushed both winter and summer to the bitter end, which is well within sight.

As the commercial timbers of to-day are rapidly being exhausted, trees heretofore regarded as worthless, are gradually coming into use. The Forest Service of the United States Department of Agriculture is experimenting with and testing many woods formerly passed by as useless. Until now, except where the hardwoods were slashed out and left to rot to facilitate the removal of the softwoods, the White Mountain slopes have been protected by a fair stand of these almost worthless kinds. If they become marketable, and it seems quite probable that they shortly will, then woe betide the mountains.

The people of New England as a whole believe that timber was given us to use. Indeed, lumbering is one of the great industries of the region, and the people naturally desire it to continue as one of the sources of general wealth. Under the methods at present in vogue in those mountain forests, the industry must be permanently injured, and the lumbermen assert that they cannot afford to do business on any modified basis. It is probably impracticable to log the steeper slopes, which chiefly lie on the higher altitudes, except on the clean-cut plan. To cull the trees would not in the least safeguard the forest, since those left would almost certainly be wind-thrown the first winter. So off comes the forest cover to the last stick and eventually down comes the scanty soil to the last particle under the scouring rain and melting snow. The trash infrequently gets fired by carelessness or malice and the remaining timber is menaced, the remaining soil wholly

burned away, and desolation is complete.

Just how great is the effect of all this upon the water powers deriving their sources in those mountains cannot be set forth to-day in cold figures. The users of the power in many places state that they have for some time been able to note the changes in power from season to season, and cite the more frequent and more damaging freshets, and the more protracted droughts of recent years.

New England feels that those mountain forests should be protected so that they may be lumbered in perpetuity so far as is consistent with other economic interests. The present owners of those tracts cannot do this with justice to themselves, and after much mature consideration of ways and means, it has come to be the belief, not alone of the people of the section involved, but of expert advisers called in from other parts of the country, and of many men of sound judgment also resident elsewhere, that the only solution of the problem is for the nation to establish there a federal forest reserve.

Such an achievement would mean much to the prosperity of New England, and therefore to the nation, and it would be but a slight tax upon the country to bring it to pass. Accepting the figures of the federal Forest Service, based on a careful examination of the whole White Mountain territory by the government foresters a year ago, the area of the mountain country is only about 812,000 acres. The total area of all the federal forest reserves at the present time, exclusive of Alaska and Porto Rico, is about 91,000,000 acres. These reserves, 92 in number, are situated in the west, in Arizona, California, Colorado, Idaho, Montana, Nebraska, New Mexico, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming. New England asks that a comparatively small area be set aside through federal purchase, and added to the nation's forest domain, an area equal

to only about one per cent. of the reserves enumerated above.

In no other way can those mountain forests be preserved for the good of the people for all time. The west has forest reserves for the production of a steady timber supply, and to preserve a steady flow of water for the valleys. It has in addition a great number of large national parks, set aside purely and simply to preserve natural features of great beauty. New England glories in all these as splendid national possessions, and believes in them, and in the policy which led to their creation. She asks her sister states of the west and south to aid her in establishing in the northeast a comparatively small domain which shall serve as a national park and a forest reserve in one.

Is not a little piece of country like this worthy of our fondest care when it can show 74 mountains of over

3,000 feet elevation, 11 of them being over 5,000 feet, and one, Mt. Washington, 6,290 feet, the second highest peak east of the Mississippi River?

Especially worthy of attention, it seems, when it is considered that 956 brooks, large enough to be shown on a two-mile to the inch map, rise in the mountains. Of these 143 feed the Androscoggin River, which turns mills in New Hampshire and Maine. One hundred and forty-eight flow eventually into the Connecticut, probably the principal river of New England, and in which New Hampshire, Vermont, Massachusetts, and Connecticut, are all vitally interested. The Merrimac receives the water from 210 of these brooks, and this is one of the great cotton mill streams of New Hampshire and Massachusetts; and 455 serve the Saco, another stream of commercial importance to both New Hampshire and Maine.

TREE PLANTING ON MINNESOTA PRAIRIES

BY

GEORGE L. CLOTHIER

United States Forest Service

THE desirability of forest plantations on the prairie farms of Minnesota is generally conceded. Differences of opinion that exist concerning the advisability of the establishment of such plantations are usually caused by a lack of information as to the most desirable species, the proper location of the plantations, the best methods of establishing the same, and the profits likely to accrue from planting. The following pages will be confined chiefly to the discussion of some of these questions.

SELECTION OF SPECIES.

Among nurserymen and farmer tree planters generally, dogmatic assertions concerning the merits of different spe-

cies are likely to be made. Judgment is too often based on results gotten from temporary trials. A new species or variety comes before the public and everybody plants it without questioning its desirability. The fact that it sells well is the quality most highly esteemed by the average tree dealer. The question as to what the future tree will develop into seems seldom to concern many of our people. An illustration of this point is the use of the diamond willow. A few years ago some enterprising dealer took it into his head to advertise the diamond willow as a good fence-post tree. Everybody began to clamor for diamond willow, and dealers tried to supply

the trade. These willows were sold to farmers for fancy prices and planted on the prairies of Minnesota and the Dakotas on hundreds of farms where the worthless shrub was growing wild along the banks of every pond and water course. Nobody seemed to have cared to inquire whether or not the

The use of the white willow in Iowa is another illustration of the extensive planting of a species without knowledge of its disadvantages. During the early settlement of the prairies of Iowa, the farmers planted the white willow in single rows on both sides of the public highways. For a few years



Mixed Plantation of Cottonwood and Boxelder in Red River Valley. The Boxelder served a Useful Purpose as Ground Cover, Keeping the Grasses from Gaining a Footing Under the Thin-Foliaged Cottonwood. Age About 15 Years; Height, 50 Feet; Diameter, 8 to 12 Inches.

diamond willow attains the size of a tree, or is long lived, or is adapted to prairie planting. Many a Minnesota farmer will regret the planting of diamond willows, and his experience will disgust and discourage him and hinder the whole tree planting movement.

it seemed that these plantations would be a great source of profit to the owners; but now one hears scarcely anything but condemnation of the white willow where it was so popular twenty years ago. To be sure it thrives, but it has become a nuisance in many

ways. Its roots stop up the tile drains; it shades the roads so densely that the surface moisture does not easily dry out and mud holes are now common where the roads were always good before the planting of the trees; it likewise causes snow drifts in winter to fill up the highways.

The one mental attitude of people which is responsible for more failures in tree planting than all other causes combined is the desire for rapid growing species. The willow grows very rapidly, hence it appeals to the pioneer planter. The cottonwood, boxelder, and silver maple are fast growing but short lived trees. They have sometimes been planted in western Minnesota, Iowa, and the Dakotas, too often for profit. During the first few years they grow very rapidly on almost any kind of soil, but when planted on upland with a stiff clay subsoil, these species begin to become stag-headed when about twenty years old, and in twenty years more the plantation is usually dead and only its remnants are left to disfigure the farm.

Instead of demanding that the only qualification of a forest growth be rapid growth, the planter should inquire whether or not its growth will be long continued, though it may be slow. The greatest forces in nature move slowly, silently, and often unnoticed. Minnesota planters who contemplate the establishment of permanent plantations on the prairies should consider the merits of such frugal species as the hardy conifers, oaks, ashes, elms, and hackberry. There is no doubt but that the list of desirable species will be widely extended in the future as experiments demonstrate the adaptability of other species. The future list will likely contain slow growing species rather than rapid. By the proper selection of seed from the northern limits of distribution, it is very probable that walnut, hickory, and other valuable hardwoods may be added to the list of desirable trees for planting in western Minnesota. The

red and burr oaks are the most hardy species of this genus.

The planting of the more fastidious conifers, such as white pine, in the Red River Valley is not advisable, yet experiments in this region with the balsam fir, arborvitae, white spruce, and European larch should be made. It is an indisputable fact that evergreens are more desirable on prairie farm plantations than deciduous species, because the protective effect of the foliage in winter has a great indirect value.

SELECTION OF PLANTING SITE.

The farmer tree planter should deliberate when selecting the site for his grove, and not leave this matter to be settled by chance. The determining factors influencing the selection of the site are the following:

1. Degree of permeability of soil and subsoil rendering tree growth possible, or prohibiting it.
2. Depth to ground water.
3. The proper planning of the fields and private roads on the farm, and location of public roads adjacent to the same.
4. Location of the buildings and farmstead on the farm.
5. Need of protection such as windbreaks, snowbreaks, etc.
6. Amount and location of waste land on the farm and its availability for planting.

Consideration of the question of adaptability of soil and subsoil cannot well be too carefully given. Much of our prairie land that produces excellent agricultural crops will not produce a permanent growth of trees without great care. Planting on such land, except experimentally, is likely to be a waste of time and energy. If an impenetrable substratum, of clay or rock, exists as near to the surface as two or three feet, it will probably be next to impossible to grow trees successfully on such ground.

Depth to permanent moisture is another very important point to consider. Where the ground water stands too near the surface successful planting is

very difficult, and where the subsoil is dry to great depths tree growth is precluded.

The location of every forest plantation on a farm will largely be determined by the size, position, and shape of the fields. The private and public roads will also have influence. No farm can be properly laid out without considerable thought having been devoted to the adjustment of the subdivisions of it; and when permanently

causing snowdrifts in winter to cover up the residence and barns and hinder the work on the farm. Provision for proper circulation of air about the buildings in the summer should also be made. For this reason the forest belts on a farmstead should enclose a liberal allowance of space around the buildings. The position of the buildings with reference to other parts of the farm and with reference to neighboring farms will also determine in a



Grove of Aspen Sold to Planter for Prairie Planting as "Yellow Cottonwood." All Have Died Except the Clump Shown, which Occupies a Basin with Very Moist Soil. Example of the use of Poor Species. North Dakota.

planned belts of planted trees can very conveniently be placed at the borders of the fields. In such positions they will serve the purpose of windbreaks and also not interfere with the easy tillage of the land.

The position of the buildings on a farm should have very great weight in determining the location of the forest plantations. The usual tendency is to plant the trees too close to the buildings and thus to create conditions

measure the position of the trees; for if a natural timber belt on a neighboring farm affords protection from the north wind, the planter is hardly justified in planting a belt on his own land for this purpose. He could place his planted trees in some other direction to greater advantage. The need of shelter and windbreaks is so urgent upon the majority of prairie farms, particularly in the Red River Valley, that this subject cannot well be em-

phasized too much. It is difficult to estimate the amount of comfort that can be derived on a bleak prairie from a shelterbelt of forest trees.

Every forest plantation on the unprotected prairies of Minnesota should have a secondary protection, consisting of a separate forest plantation. This secondary plantation has been named a "snowbreak." The purpose of the snowbreak is to cause the snow to drift outside the boundaries of the main forest plantation or outside the farmstead. As is well known, snowdrifts form on the lee side of the obstruction causing the drift rather than on the windward side. For instance, a belt of trees running east and west along the north side of a public road will cause the road to fill up with snowdrifts, providing the prevailing wind be from the north. If the farm forest plantation is in the form of a block, the snow will pile up in the whole block almost to a uniform depth, and during the long winter season it is not likely to melt off in such a situation; on the contrary, it will constantly accumulate, sometimes getting to be twenty-five or thirty feet in depth. When it begins to melt in the springtime it will settle down on the branches of the trees and crush them. Many an excellent grove in western Minnesota and the eastern Dakotas has been almost ruined in this manner by the drifting and settling of the snow. If the plantation is a narrow belt, and a space between the belt and the object to be protected is provided, the most of the snow will drift on the lee side of the belt outside of the boundaries containing the trees and in this space. A snowbreak should consist of an L-shaped belt of trees one or two rods wide, planted about ten rods to the windward of the main forest plantation; that is on the north and west sides in Minnesota. The main body of this belt may be planted with cheap species of trees, such as white willow, cottonwood, boxelder, etc., whose breakage will not be any great damage to the plantation or much loss to the

planter. The row on the extreme north and west should consist of a tall-growing species, an evergreen such as pine or spruce being preferable. The remainder of the rows may consist of almost any cheap species. The open space ten or twelve rods wide between the snowbreak and the main forest plantation will serve as a trap for the snow into which the drifts will be piled.

The location of the forest plantation will be determined to a considerable degree by the amount, kind, and position of any waste land that may happen to occur on the farm. It is always a good financial policy to utilize the waste corners of the farm for forestry purposes whenever possible.

METHODS OF ESTABLISHING A FOREST PLANTATION.

Even after two or three decades of experience in tree planting in the prairie states the popular mind is still greatly clouded as to what is meant by a forest plantation and what methods should be used for its establishment. Many of our nurserymen, whose customers are chiefly city people, have confused forest planting and landscape gardening. Their catalogues abound in eulogies of imported species from all quarters of the globe. They advertise novelties as though such material had been tested and its merits proven. They place fancy prices upon their nursery stock and expect the planter to be able to purchase this material to be used in a forest plantation. A little figuring will probably throw some light on the possibilities of farmers following their advice. A nurseryman who can sell transplanted Norway spruce trees two feet high for twenty-five cents apiece seems to think that he is offering goods at bed-rock prices and often cannot quite understand why every forest planter in Minnesota does not give large orders for this kind of material. He forgets that a forest plantation to be of any value must have a sufficient number of trees on it to shade the ground as nature does in her forestry operations. In

order to secure a good cover of Norway spruce within ten or fifteen years at least 1,000 trees should be planted per acre, and 2,000 would be better. One thousand Norway spruce trees at twenty-five cents apiece would cost \$250. No farmer who has good busi-

ness sagacity is going to invest \$250 per acre in the nursery stock of a prospective forest plantation. The average Norway spruce forests of Germany are not worth \$250 per acre on the stump when the trees are one hundred years old. The proposition that a farmer should invest \$250 an acre in

the establishment of a forest plantation that must require one hundred years of growth before it is mature is so absurd that it seems that no sane man would give such advice, and yet such advice is common. A capital of \$250 put at three per cent. compound



Cottonwood Grove on Upland in Northwestern Iowa. This River Bottom Species is Now Dying, After Having Occupied the Ground Twenty-five Years, and the Prairie Grasses are again taking Possession of the Land. This Picture Illustrated the Use of the Wrong Species for the Site.

ness sagacity is going to invest \$250 per acre in the nursery stock of a prospective forest plantation. The average Norway spruce forests of Germany are not worth \$250 per acre on the stump when the trees are one hundred years old. The proposition that a farmer should invest \$250 an acre in

interest would amount to \$3,800 in one hundred years.

One of the greatest needs we have to-day for furthering the cause of forest tree planting is a class of nurserymen who comprehend the situation and who have enough energy about them to grow evergreen seedlings by

the million at a cost that will permit of forest planting as a safe business venture. Present prices and present methods of nursery practice, particularly with conifers, are hindering the cause of forest planting more than all other influences combined. Our nurserymen must learn that a forest plan-

customer need not be ignored who wants a half-dozen trees once a year to plant on his blue grass lawn and is willing to pay a good, round price for the operation of transplanting which such trees require preliminary to the endurance of hard and unnatural environmental conditions; but these peo-



Grove of European Larch, 16 years old at Clear Lake, S. D., in Winter, Showing Contrast Between the Larch and Norway Spruce, both Species having been Planted at the Same Time.

tation is not a lawn or dooryard plantation, that for forestry purposes very small seedlings are much to be preferred to expensive transplanted trees, and that the present methods of nursery practice can be improved and cheapened to a great degree. The city

ple are not all the people in the world who desire to plant trees. Minnesota farmers ought to plant millions of forest trees where the city people plant scores, and they will plant in the future by the millions if the grower of seedlings will put the cost of this

planting within their reach. If the present lack of consideration for the needs of farmer planters continues in Minnesota and the Dakotas for the next two decades, state nurseries will be established for the growing of coniferous forest seedlings at reasonable rates. If the nurserymen of the Northwest are willing that this great opportunity for business should slip out of their hands and be absorbed by the state, the best way for them to

boxelder, valuable, long-lived species will be used. A few examples of profitable groves are the following: A sixteen-year-old planted grove of European larch near Clear Lake, S. D., a few miles west of the Minnesota line, was measured in the fall of 1901. At present prices the nursery stock from which these trees were grown would cost about \$10 per thousand. No record of the prices that were paid at the time the plantation



White Willow Snow-Break, 4 Years Old, with Open Space (Snow Trap) in Front.
North Dakota.

bring this about is to continue the attitude of ignoring the forest planter.

COST AND PROFITS OF PLANTING.

An acre of forest can be planted with 1,500 seedlings of the common deciduous species for \$10, or even less, counting nursery stock and labor. Whenever the farmer can plant evergreens for the same price, coniferous plantations will be the rule in Minnesota. Instead of the farm plantation consisting of willow, soft maple, and

was made are available as the owner kept none. The labor of planting was largely done by the plow, the ground having been furrowed out and the trees set in the furrows. It is safe to estimate the total expense of establishing this plantation at \$20 per acre. When it was made, the land which it occupies was worth about \$10 per acre, so that the total investment can be reckoned at \$30 per acre. In 1901 this plantation had produced 1,054 first-

feet tall, growing thriftily, and no doubt in much better condition than larger trees would have been if they had been planted. This is an illustration of the methods that must be employed in order to make forest planting a financial possibility.

A Minnesota farmer usually plows his land preparatory to tree planting, and in the prairie regions this is absolutely essential to success, though it is not necessary in the east. The cost of

absolutely essential and adds materially to the cost of the plantation.

The Minnesota farmer, however, has in store as a reward for his extra labor and expense the prospect of a market far superior to anything that can be hoped for in the near future in the east. The millions of fence posts that are used every year on the prairies of the West must be replaced in a few years by others. The demand for fence post timber is constantly increas-



Near View of White Willow Snow-break, Grown in Four Years from Cuttings.
North Dakota.

plowing the land where gang plows are used ought not to exceed 75 cents to \$1 per acre. Minnesota farmers will also need to provide cultivation after the trees have once been established. In the more humid eastern states forest trees are left to take care of themselves and are able to compete with any other weedy plants which might interfere with their growth. On the prairies of the west, cultivation to keep the grasses out of the grove is

ing and this can be grown in comparatively a very short time. The telegraph and telephone pole industry is also likely to prove very profitable in the future. European larch telegraph poles can be grown in twenty to twenty-five years. When we remember that such poles now are selling for \$1 to \$2 apiece on the prairies and understand that 250 to 500 poles may be grown per acre, we begin to see what the possibilities are for commercial

plantations of this sort. On the whole, the prospect offers encouragement for Minnesota tree planters. The question of the supply of material with which to plant is bound to solve itself. It will perhaps be a number of years

before farmers can buy the most desirable kinds of forest trees and can be sure that what they are buying is true to name, but the time is certainly coming when such conditions can be guaranteed to Minnesota planters.

LUMBERING IN THE SOUTHERN APPALACHIANS

Now and Under Government Ownership and Supervision

BY

OVERTON W. PRICE

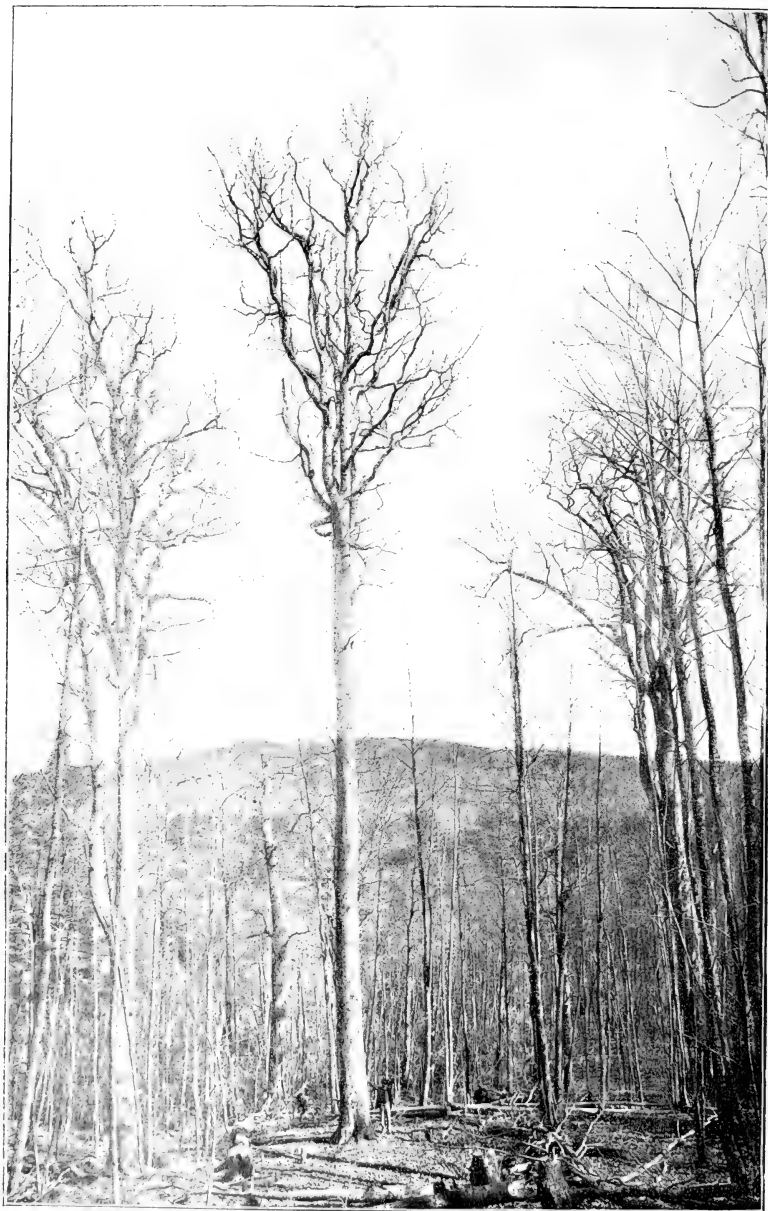
Associate Forester, U. S. Forest Service

THE protection of the headwaters of important streams in order to prevent floods and perpetuate water powers, the preservation of a great natural health resort and of important agricultural resources, are perhaps the most valuable results that would follow the creation and management of the proposed Southern Appalachian Forest Reserve. The application of practical forestry in this region by the federal government would bear fruit also in the maintenance of a sustained supply of hard-wood timber, in the production of a steady and increasing income therefrom, and in providing a forcible object-lesson to show the advantages of careful and conservative forest management.

Lumbering is one of the principal industries of the Southern Appalachians. The agricultural resources of the region must remain limited because of its ruggedness and the low percentage of arable land. Its development as a grazing country is hampered by the lack of winter forage and the temporary life of the grass covering in the lower slopes. Its main resource of the future will be its hard-wood forests, upon whose maintenance depends very largely the best and most permanent development of western North Carolina and eastern Tennessee. The existing supply of merchantable

timber has already been seriously reduced, while repeated fires and unregulated grazing have in many localities greatly impaired the quality and health of the forest, as well as the chance of its successful reproduction. Although there is still enough wood left to fill the local demand, the cost of logging it is constantly growing with the increasing distance between the market and the source of supply. Around each settlement there is a rapidly widening area which has been stripped of all merchantable timber under methods which too often render it practically valueless for the production of a second crop. In many localities serious harm has already been done, which only time and care can remove. A continuance of such methods will within the near future destroy this great natural resource of the Southern Appalachians—the lumbering of its valuable hardwoods to supply a steady and growing demand.

The application of practical forestry to the proposed reserve would not only preserve the productive capacity of the forest within its boundaries, but it would also provide a proof of the results of conservative forest management which would be of value in inducing private owners of forest land in this region to adopt the same measures. There is no surer or quicker



Reproduction of Hard-wood Forest in the Southern Appalachians. The Large Trees Have Supplied the Seeds from which the Smaller Ones Have Grown

way of convincing the lumberman of the Southern Appalachians that conservative lumbering pays better than ordinary lumbering than by an experiment on the ground, based upon a thorough study and effectively carried out.

The question of direct returns from the proposed reserve is, from the point of view of the federal government, a secondary one. Its highest benefit will

make conservative lumbering a sound business measure. The pecuniary advantage of practical forestry depends naturally upon whether it offers better returns than those to be had from ordinary lumbering. Since it reduces present profits slightly in order to insure a second crop of timber upon the lumbered area, its superiority from a business point of view rests upon the safety and value of the second crop.



Tops Left Among the Trees in Logging. These Feed the Forest Fires so Effectively that They Sometimes Destroy Everything in Their Path.

lie in those indirect returns which are so vital an importance to the best development of this region and its resources. However, that the forests of the Southern Appalachians can under systematic and conservative measures be made to yield a profit from their management is certain. Although local stumpage values are not sufficiently good to warrant the application of an elaborate system of forest management, they are high enough to

Serious danger from fires, a poor market, excessive difficulties to overcome in logging, or any other adverse conditions which seriously impairs stumpage values, may render the probable future returns from a forest insufficient to justify conservative measures in lumbering it.

Not only is there no unfavorable condition in the Southern Appalachians which is sufficient to render practical forestry inadvisable as a bus-

iness measure, but the opportunity offered for good returns from careful and conservative forest management is a peculiarly favorable one. The forest contains valuable timber trees, which not only command a high price at present, but are rapidly increasing in value for the lack of satisfactory substitutes, notably in the case of black walnut, cherry, hickory, yellow poplar, and white oak. The transport of timber presents some difficulties, as in all mountain countries. These are, however, seldom sufficient to impair seriously the profits from lumbering. Effective protection from fire is practicable without prohibitive expense, while in its rate of growth, readiness of reproduction, and responsiveness to good treatment, the forest offers silvicultural opportunities which are seldom excelled in this country.

Practical forestry in the Southern Appalachians must comprise those modifications of the present methods of lumbering which will not only insure a fair profit upon present operations, but will preserve the productive capacity of the forest and provide for the desired reproduction of the timber trees. Unnecessary damage to the forest and total lack of provision for a future crop is characteristic of the lumbering now carried on in this region. Logging operations have generally shown an inexcusable slovenliness, as foreign to good lumbering as to practical forestry.

A clean lumber job is seldom seen. There is great waste of good timber through poor judgment in gauging the log lengths and in cutting stumps much higher than is necessary. Butting off unsound portions of trees is not always done; trees not wholly perfect are sometimes left to rot where they fall. Care is seldom taken to throw trees where they will do the least harm to themselves and to others, and in consequence lodged and smashed trees are very common. Overlooked sound trees are also numerous.

However, criticism of lumbering in the Southern Appalachians must take

into consideration the circumstances which led to it. Almost all of the work has been done by the farmers of the region in order to supply their fuel and other household material and to add to the poor living afforded them by their farms. These men are often hampered by lack of capital, are generally wanting in the knowledge requisite to good lumbering, and have had always to contend with the difficulty of obtaining expert loggers to carry out the work. Nevertheless, the nearness of large bodies of merchantable timber, among which are valuable kinds, such as cherry, black walnut, hickory, and yellow poplar, has usually made a fair profit possible under even the most thriftless logging methods. This desultory cutting has been going on for years, and although the individual efforts have been small, they have removed the merchantable timber from the larger portion of the accessible forests.

When the waning supplies of timber in the north and east some fifteen years ago forced the loggers of those regions to the south, the application of skillful and systematic methods of lumbering began in the Southern Appalachians. The newcomers, through the investment of commensurate capital in logging outfits, the thorough repair and extension of logging roads, and the generally business-like mode of attack characteristic of the trained lumberman, have reaped a profit from their operations entirely impossible under the slipshod, desultory lumbering methods of the settler.

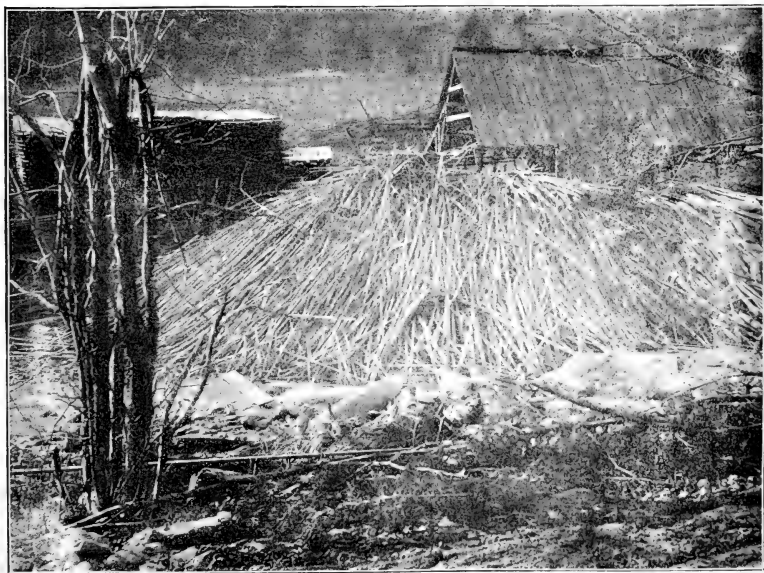
The harm done to the forest in both cases is very great in proportion to the quantity of lumber cut. This is due largely to the size of the trees and the fact that little care is taken in the fellings. The damage to young growth is increased by the absence of snow, and by the fact that trees are often cut when they are in full leaf.

The breaking down and wounding of seedlings and young trees by the snaking of logs to the roadside or the river is in some degree unavoidable;

but the damage is often much in excess of what is necessary. There are often, however, many more snakeways, or skidways, than are necessary, and the application of a little system in laying them out would save time and young growth on a lumber job. On the higher and steeper slopes it is often the habit—and one which cannot be criticized too strongly, except in those rare cases where it is absolutely necessary on account of the gradient—to

example, of leaving to rot the “deadened” trees which stand over clearings. There are cases in which these clearings have been inclosed with fences built of rails split from prime black walnut, with no other excuse than that the walnut happened to be within easier reach than either oak or pine.

Under such methods, in which there is not only an absolute lack of provision for a future crop, but often a marked absence of that forethought,



Waste in Sawing at a Small Mill in the Southern Appalachian Mountains.

roll the logs from top to bottom, merely starting them with the canthook. A 16-foot log, 3 feet or more in diameter, can gain momentum enough in this way to smash even fair-sized trees in its path, and when it passes through dense young growth it leaves a track like that of a miniature tornado. The practice is in line with others to be observed in the Southern Appalachians, such as the common habit, for

skill, and aversion to waste which go to make clean lumbering, most of the logged-over areas in the Southern Appalachians are only saved from entire destruction of the standing trees by the generally scattered distribution of the merchantable timber.

In the application of conservative forest management to that portion of the forests of the Southern Appalachians included within the proposed

reserve, the first aim should be to protect them from fire. The safety of the forest from fire must form the foundation of any system of practical

region. The chief cause lies not in malice or in carelessness of campers or of lumbermen, but in the ancient local practice of burning over the for-



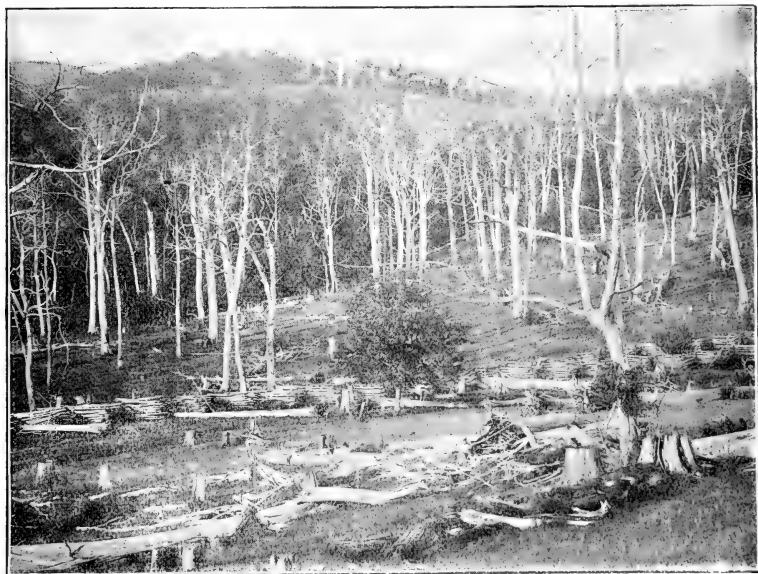
Unnecessary Forest Destruction Along the Snaking Trail.

forestry which is to be permanently successful. Fire has done, and continues to do, enormous damage in this

est in the autumn, under the belief that better pasturage is thus obtained the following year.

The fires are started by the settlers upon the area which is to serve as a sheep or cattle range the following season, and are permitted to burn unchecked. The result is that, except where confined by roads, streams, or clearings, they often spread from the woodlots of the foothills, in which they are set, to the forests of the mountains, there to burn unmolested until rain, snow, or lack of inflammable material puts them out.

good results of its preservation from fire would be two-fold. In addition to the evident benefits of efficient fire protection upon the forest would be the forcible example provided to prove that the forest untouched by fire yields in the long run better and more plentiful pasturage than if it be annually burned over. The modifications of present methods of grazing in the Southern Appalachians, like the modification of present lumbering



Destruction of Forests on Mountain Ridges for Pasturing Purposes

The hardwood forests of the Southern Appalachians are by no means so inflammable as the coniferous forests of the north and west. Forest fires in this region are seldom more than ground fires, and only under the influence of exceedingly high winds in a dry season become uncontrollable. With an active and adequate force of rangers and a thorough system of trails, the protection of the proposed reserve would be practicable. The

methods, will follow proof of its advantages much more rapidly than it would follow propaganda. The one is no less important to the best development of this region than the other. The advantages of both could in no way be better established than by their practical illustration in the proposed reserve.

The mountain forests of the Southern Appalachians are silviculturally the most complex in the United States.

They contain many kinds of trees, varying widely in habit and also in merchantable value, and the forest type is constantly changing with their differences in elevation, gradient, and soil. Their best management is difficult, because the lack of uniformity in the forest renders it necessary constantly to vary the severity of the cutting and to discriminate in the kinds of trees which are cut, instead of following only those general rules which suffice where there are fewer species represented and the forest conforms more closely to a single type.

In order to reproduce these forests successfully and to minimize the damage done by lumbering, first of all it will be necessary to have a radical improvement in the fellings. Such an improvement is entirely practicable without additional cost per 1,000 feet B. M. of timber felled. It often requires no more labor to fell a tree up a slope than down it, or upon an open space rather than into a clump of young growth; and it is in just such cases as these that unreasoning disregard for the future of the forest is commonly manifested in the Southern Appalachians.

In the selection of trees to be felled the small farmers, who for a long time

were the only lumbermen in the Southern Appalachians, have been governed by the same considerations that govern lumbermen elsewhere. They have taken the best trees and left uncut those of doubtful value rather than run the risk of loss in felling them. Furthermore, the fact that they have lumbered generally on a very small scale and have often had great difficulties with which to contend in the transport of logs has led to extremes in this respect. The result is that they have reduced the general quality of the forests in a measure entirely disproportionate to the amount of timber cut. As a rule, only prime trees have been taken, and those showing even slight unsoundness have been left uncut, except where the stand of first-class timber was insufficient. Diseased and deteriorating trees remain to offset the growth of the forest by their decay and to reduce its productive capacity still further by suppressing the younger trees beneath them, while in the blanks made by the lumbering, worthless species often contend with the young growth of the valuable kinds. In other words, the lumbering has closely followed the selection system, but the principles governing the selection have usually been at variance with the needs of the forest.

VALUE OF MINNESOTA FOREST RESERVE LANDS FOR SETTLEMENT

BY

HERMAN H. CHAPMAN

U. S. Forest Service

THE creation of the forest reserve by act of Congress, from the lands lying within the Chippewa Indian Reservation, in Minnesota, came as the result of a compromise between interests favoring the relinquishment of the entire reserve to settlement, and those desiring the creation of an immense national park. Neither of these

extreme views represented the best interests of the public concerned; and in this case, at least, the compromise action taken was far better than either extreme. The elements of a park are as well preserved and the public as amply benefited by the setting aside of the ten sections of virgin Norway pine along the shores of Cass Lake, as

though the whole reservation had been spared from the axe, for it is these lake shores, easily reached by launch and canoe, that will be the future attraction, and not the more inaccessible interior lands of the reserve.

It is more difficult to show why the retention of 225,000 acres of land for a forest reserve is better for the public than its opening for settlement, and the justification of such a course is based wholly on the character of the land retained. It was on the assumption that such a course was justified that the reserve was created, for the declared policy of federal forest reserves is to exclude or release all large areas of truly agricultural lands and open them to settlement.

The character of the soil, then, is of prime importance. Over such a large tract this varies greatly, but within the area of the lands already, or to be selected for the reserve, it is marked by comparative absence of swamps, and fairly level surface. Its suitability to farming then depends on the soil itself and not on its topography, drainage, or rock. A superficial examination, aided by the persuasive eloquence of some enthusiastic townsite speculator, would possibly convince one that all this land would make good farms. But the government is fortunately not compelled to make up its mind on the basis of arguments as shallow as is the layer of dark soil overlying the deep sterile sands of some of these lands. That most of this land is sandy, not even the townsites men deny. The question is: how sandy, and what can be done with such sand. The best answer to the first question is the timber found upon the land. Jack pine is at home on the deepest, purest, and most sterile type of sandy soils. The tree is extremely drought-resistant, and, while it will come in on good soil, the old, pure stands are seldom found except in pure sand. Norway pine in pure stands grows on soil nearly, if not quite, as sandy as the Jack pine, and is often found associated with it. But

white pine is never found pure in old stands on such sands. Its presence indicates clay in the soil or subsoil, and a greater capacity to hold moisture. Hardwood land is beyond question agricultural. Sandy soil with no retentive subsoil, such as Jack and Norway pine are found upon, is a treacherous soil. It is a *quick* soil. The open and loose character of the soil allows decomposition to proceed rapidly. The surface, when wooded, holds a slight accumulation of fertility in the shape of humus from the decay of pine needles and leaves. When the land is broken, this humus for two or three seasons holds moisture, and by its decay liberates fertility for the crops. This fertility is with equal rapidity washed into the deep sandy subsoil by the rains. Sandy soils recently cleared of timber are often remarkably fertile, for a while. But the regions where such soils, after years of labor have been put upon them, have completely played out and been abandoned, with their improvements, are numerous in older communities. Not 100 miles from St. Paul is a settlement thirty years old. The dividing line of prosperity among the farmers follows the boundary of the hardwood lands with significant precision. On the one side are well cleared and highly valued farms with substantial improvements. On the other, Jack pine and a few small clearings. In the hardwood, the original settlers are still there or have sold at a high figure. In the Jack pine, only one man is left of the pioneers, and the others have to a man, moved away, died or sold out, leaving tumbledown homesteads and fields where the sand blows and banks up along the roads. The lone settler, a man of foreign birth and great energy, has cleared a large farm, but so fierce has been the struggle that after twenty-five years he has not a dollar ahead and his soil is almost completely exhausted, while some of the children, through the effects of worry and insufficient food, are idiotic and have become county wards. In the face of

this showing, this sand community is now busily engaged in inducing a new crop of settlers to buy these lands from the speculators who secured them for taxes or a song, from the first victims, that the process may be repeated. It is claimed that these settlers were incompetent farmers—that what is needed is clover and better rotations. The only reason why they were poorer farmers than those who succeeded on the good soils, is that no sensible and thinking farmer would ever settle on such sandy soil.

As to methods of farming, these are soils too poor to farm continuously by any scientific method. Clover will do wonders in maintaining the fertility of sandy soils, but clover itself will cease to do well after a few years. Cropping, cultivating and stock raising on Jack pine sands, and the use of manure, cannot be depended upon to keep up the fertility of a soil requiring fresh fertilization every year or two, for one cannot raise enough stock on a farm to manure it fully oftener than once in five or six years, without a large amount of extra pasture and winter feed. Improved methods of farming are admirable, but on the poorest sands they will not solve the problem. Such soils, where, as in this case, the government has a clear title, should be withheld from settlement to prevent the evil and suffering inevitably following an attempt to farm them. That all of the land set aside on the Chippewa Reservation for forest reserve is of this character, is not true. But it is true, as anyone can determine for himself, that a large part of it is. Under the pressure of necessity, in response to the general demand that the selection be made, and owing to the complications and difficulties arising from the enormous number of Indian allotments, and in order to release as much land as possible from the operation of the restrictive reserve clauses, an area large enough to contain the 225,000 acres

of available land was designated, and the rest of the reservation vacated permanently.

If it had been possible to wait until the host of other claims, including allotments, flowage rights, and state swamp land selections, had been settled, the 225,000 acres whose selection was made mandatory by the Morris law, might have been made in a way to exclude all but the sandiest lands. But as these titles are not yet settled, such a policy would have prevented both lumbering and settlement up to the present day. As it is, the area selected contains more sandy land than any other equal solid area in the reservation. No objection was officially made to this selection until after the entire area remaining had been disposed of, either to lumbermen who will cut the timber clean leaving no seed trees, or thrown open for entry, to settlers. This soil is naturally adapted to Jack and Norway pine and the method of cutting by which 5 per cent. of the mature timber is left to seed the ground, is that best adapted to the demands of the pines and will be attended with great success, especially if public sentiment aids in the prevention of fires. Much could be written about the admirable work that has already been done in carrying out the regulations, which has demonstrated conclusively their practicability. If the object of the reserve is attained, Cass Lake will in time be the center of a new pine forest of greater value than the one now being cut. The question of settling the better lands within the reserve is one which need concern no one honestly interested in the protection of the bona fide settler. The general policy of forest reserves, applied to this reserve, will take care of that. But the government must set its face firmly against a deliberate attempt to deceive the public and misuse these sandy lands by allowing well intentioned settlers to fritter away the best part of their lives in a hopeless effort to make farms upon them.

FUTURE OF THE MISSISSIPPI RIVER

The Effect that Destruction of Forests
will have Upon its Headwaters

BY

CHARLES CRISTADORO

THE forests have been looked upon by the settler both as an enemy and a friend. Unless the land was cleared of trees, no crops could be raised and so with ax and saw he felled them. Yet they gave him the lumber for his house and kept his fire-side alight and warm during the long winter days and nights. So fared the giant black walnuts of Indiana in the early days when the massive logs were split and hewed into fence rails, those remaining in excess of the winter's need for fuel piled high afield and burned, as one would to-day, in clearing a field of so much brush.

The great Michigan forests of white pine, that nodded to the summer's breeze and swayed before the winter's blasts, appeared not many years ago as inexhaustible and limitless, yet they in time disappeared and vanished as snow upon the yet warm earth, before the ax and saw of the settler and lumberman. The extravagances of the early lumberman would make the lumber operators of the present day bankrupt were they to follow them.

As the millions of buffalo disappeared from the face of the earth so have gone the forests of white pine that stood in a continuous, unbroken chain for hundreds of miles.

The forests were made for man to use, says the practical lumberman. 'Tis true—but only in a measure. They were made for man to use and for the use of man. So were the rivers. The water sources, trace them as you may, will be found in the forest. There the spring gives forth its swelling flow that makes the brook, that makes the stream and finally the river as it flows

toward and empties itself into the ocean.

Remove the water protecting trees and you interfere with the supply that the springs give forth. In other words, history the world around, reveals the fact that with the timber removed from a river's headwaters, so has the death knell of the river been sounded. Examples of this kind can be shown in all countries.

We must have water, whether it comes from subterranean or surface rivers or flowing springs and rippling brooks; it matters not, water we must have, without it we can not live. To secure this commodity of nature, the great cities spend millions of dollars to follow it to its source, store and lead it to the cities for consumption. The ancient Romans left us a lesson in aqueducts that has been a speaking example.

With the destruction of the timber along the water courses, floods and drouths have followed. Many localities once blessed with abundant flowing water are to-day, at times, through drouth, absolutely deprived of it, because of the denudation of the timber on the sources of the river. Each State has suffered from the encroachment upon its lumber forests and, in some cases, before it was too late, the legislature has stepped in to save the timber.

When Michigan was being rapidly divested of her great white pine forests, Wisconsin was being entered by the lumbermen as a fresh field for lumber exploitation. Minnesota's pine giants were yet untouched. But the day came when the lumbermen cleared

Michigan and were swarming like bees into the pine of Wisconsin and then Minnesota's turn came. And now the end of Minnesota's timber is in sight, so much so, that those who have made millions through and by means of her pine forests are to-day investing them in the great fir, spruce and redwood lands on the Pacific Coast. The days of the white pine trees are numbered in Minnesota. And during these years one spot in the State of Minnesota has been kept sacred from the ax. It was the Chippewa Reservation covering 800,000 acres, 200,000 of which is water. From this spot the strong arm of the Government held back the lumberman. The pines were sacred and under their branches the Indians lived undisturbed.

Many were the covetous eyes cast upon this reservation as the pines beyond its borders became fewer and fewer. Many were the efforts to secure this land from the control of the Indians. Treaties were made and, as has been the case with all Indian treaties from the days of Columbus to date, broken.

Then an argument was put forth that the timber in many cases was dead and that windfalls were frequent and that such could be saved and the money given to the Indians, could the trees be cut and removed from the reservation. It was called "dead and down timber," the very name of which is so tainted with fraud, perjury and downright theft that it stinks in the nostrils of every man acquainted with its significance. But a law permitting the removal of the "dead and down timber" went through Congress, and it is stated for every actually "dead and down" tree a thousand thrifty, growing white pine giants were laid low and removed. It grew into such a nauseating, scandalous steal that the very man who fathered the "dead and down" bill, although I will say his intentions were good, was ashamed of its workings.

An effort was successfully made through the Secretary of the Interior

to stop this outrage. Then an attempt was made to have the Government protect and shield for the people, this beautiful sylvan paradise, for all time, like the Yellowstone Park, for never did a person visit this region, but that he returned with but one wish and one sentiment, can it not be preserved for all time for the people?

Here is practically the head waters of the Mississippi, although the river actually springs from Lake Itasca. But these are its headwaters for here are the three great lakes of Leech, Cass and Winnebago, with seventy smaller lakes, the infant Mississippi connecting them all and meandering among them, making one great check-board of stream and lake.

The picture of the giant pines growing even to the water's edge, the wild rice mantling the crystal stream and the phantom-like passing of an Indian-laden birch bark canoe made a picture that took one back to the days of Fenimore Cooper and made one glad that such a primitive spot yet rested upon God's footstool. With the growth of pine properly cared for under forestry rules this great watershed gave promise of feeding the Father of Waters for all time.

But two billion feet of standing timber was a great temptation to the lumberman and townsite operators, anxious to "skim the cream," and therefore the Morris Bill was passed and this great woodland paradise was thrown open to settlement and the will and wishes of the lumberman and the land speculator.

And now what has happened? The Panama Canal is to be. The whole Mississippi Valley wakes up and looks at the map and cries "We must now see that our river is deepened. We must profit by the Panama Canal and we must have a navigable highway and Congress must help us." Suppose it does take \$50,000,000 to deepen the channels of this great river, they say it's worth it and they want it done. And while the knocking for

this \$50,000,000 appropriation is heard upon the doors of Congress, so too is heard at the same time at this river's headwaters the chug, chug, chug of the keen axe, the rasping of the saw and the crash of the falling giants as they topple daily to the earth in thousands.

The headwaters are being cut out,

the very headwaters whence this mighty river is draining her supplies, and the people of the Mississippi Valley, oblivious to what is going on, are beseeching Congress to deepen the river. Cut out and dry up the river's headwaters first and then spend fifty million, yes, a hundred million dollars fruitlessly, to deepen the channel!

THE IDYLLWILD SCHOOL OF FORESTRY

BY

HELEN LUKENS JONES

STUDYING forestry in a college with books and black-boards and pictures for illustration, and studying forestry out of doors in splendidly timbered regions, are in decided con-

trast, and assuredly favor rests with the latter, for texts and pictures of trees, though often from life, are far less satisfying than actual communication with real forest nobility.



Idyllwild Cottages, San Jacinto Mountains, Riverside County, California

Perhaps no place in the world is better suited for the permanent location of a forestry school than Idyllwild, which is in the heart of the San Jacinto Mountains in Riverside county, California. Three years ago, under the patronage of Gifford Pinchot, Chief Forester of the Bureau of Forestry, and Benjamin Ide Wheeler, of the University of California, and at the direct instigation of Dr. Walter Lindley, of Los Angeles, whose inter-

dents through woods, meadows, and over mountain slopes, demonstrating with living illustrations the practicability and necessity of protecting and preserving the watersheds, and helping the students to become familiar with the different forms of tree and plant growths, and those most essential and useful for such preservation.

At first the interest of the butterfly and drone-bee tourists in the School of Forestry was decidedly lax. From



Idyllwild Bungalow, San Jacinto Mountains, Riverside County, California

est in, and devotion to our forests is well known, a Summer School of Forestry—a branch of that of the State University—was established at this beautiful resort.

Neither time nor money were spared to make this new innovation a success. Prominent men of the state, experts in their various lines of agriculture, floriculture, and forestry, were engaged to lecture during the two months' term, and to pilot the stu-

stuff offices thronged with financial problems, from homes groaning with domestic difficulties and cares, or from social responsibilities of gigantic proportions, they had escaped, and had come to the woods to rest and play, but not to think. It seemed that the management was a bit impertinent to ask them to consider anything more serious than the toasting of marshmallows over a camp-fire, the reading of "The Thrilling Diamond Robbery"

by an unknown author, spending the day peacefully snoozing in a hammock, or in exchanging choice bits of gossip—for to what delicious depths will intelligent minds descend when they have determined to enjoy a period of absolute unexertion? Theirs was a tumble from mental heights, and a frolicksome bouncing on the soft, good-natured pillow of laziness.

Gradually, however, as entertaining reports of the Forestry School pro-

practical and picturesque phases of California forestry, botany and agriculture, for the three divisions are practically synonymous so far as the good of the country is concerned.

During this year's sessions Prof. A. V. Stubenrauch, of the College of Agriculture of the University of California, who has done active and valuable work in establishing experimental horticultural sub-stations throughout the state, lectured on the economic value



Camping in Idyllwild, San Jacinto Mountains, Riverside County, California

ceedings reached the ears of the lethargic rusticators, they rubbed their eyes and their wits and finally became enthusiastic attendants at all sessions. This year much interest has been manifested in the lectures, which are given in the large hall of the new bungalow. These lectures are illustrated with electric stereopticon, and colored slides pictorially descriptive of timbered, untimbered, fire-swept, and over-grazed areas. They have to do with scientific,

of acacias, eucalypts, and other kinds of Australian and New Zealand trees and shrubs, especially those species that seem most feasible for California conditions. Mr. T. P. Lukens, of Pasadena, an agent of the Forest Service, who has devoted the past ten years to reforesting mountain slopes that have been denuded by fire, lectured on "Forest Protection," "Reforestation," "Forests of the Pacific Coast," and "Water Conservation."

His talks were illustrated by over two hundred colored slides, from his own photographs, taken while making investigations of forest conditions. Mr. Avery T. Searle, a forest assistant in the Forest Service, United States Department of Agriculture, spoke of "Forest Botany," "Silviculture," "Forest Measurements," and "Forest Laws," while Miss Belle Sumner Angier, of Los Angeles, gave one talk on the flora of the San Jacinto Mountains.

school term, from ten to fifty nature devotees ranging from twelve to seventy years of age, go in excursion through the woods, always accompanied by one or more experts who explain the names, habits, characteristics, uses and advantages of woodland growths, from the moss to pine trees two hundred feet in height. Sometimes the students follow the source of a stream through some rocky, sinuous fern-lined canyon. Frequently the students tramp through open for-



Strawberry Creek, Idyllwild, San Jacinto Mountains, Riverside County, California

That not only local, but national interest in forestry should be created, is of greatest importance, and this is what the Idyllwild School of Forestry is trying to accomplish—to make people more reverent, and more careful, so that forest fires may be prevented and injurious grazing controlled.

Educationally profitable, and certainly delightful are the outdoor classes. Every morning during the

ests, over meadows, or up rugged slopes. Once at least during the summer session, all the students take saddle horses, blankets, and provisions, and go into the high meadows of the grand peaks of the range, the highest of which, San Jacinto, is 10,700 feet above the sea and usually flecked with snow. Three days are required to make this trip. With each increase of altitude, the character and variety

of the trees and flowers that thrive in different elevations change perceptibly.

Idyllwild is especially adapted to the location of a school of forestry, because of the enormous surrounding area of forested country. The Idyllwild Mountain Resort Company owns 5,250 acres, the edges of which link with the borders of the Government

Reservation which comprises 700,000 acres. Beginning at the gate of the mountain, 500 feet elevation, where the stage road begins to wind into the wilderness toward Idyllwild and San Jacinto Peak, the latter fifty miles distant by road and trail, there extends one continuous procession of trees and flowers of many species—an unlimited Nature library of living books and texts.

RECENT PUBLICATIONS

The Structure and Development of Mosses and Ferns, by Douglas Houghton Campbell. The Macmillan Company; 657 pp.; \$4.50.

In this second edition of his standard text-book Prof. Campbell has made available a vast amount of newly-acquired knowledge concerning a group of plants (*Archegoniatae*) which has engaged the attention of many botanists during recent years. The work describes the peculiar organs of *typicae genera* and is furnished with no less than 322 figures to illustrate the text. These are apparently carefully drawn and are well reproduced. A very full, thoroughly up-to-date bibliography and a good index make the book satisfactory and usable in every way.

A Treatise on Pruning Forest and Ornamental Trees, by A. Des Cars. Translated from the Seventh French Edition, and with introduction by Charles S. Sargent. Published by the Mass. Society for the Promotion of Agriculture.

Notwithstanding the fact that this book is forty years old, and its English translation upwards of twenty, it still remains the standard text-book on tree pruning. Prof. Sargent may be wrong when he states in the introduction that tree pruning is practiced extensively in the commercial forests of Europe, but he is quite right in saying that lumber trees can rarely be pruned in this country on account of the attendant expense. It is, nevertheless, quite true that trees of all kinds may be much improved by pruning whether they are intended to furnish lumber or to be purely decorative.

The principles laid down in this little manual have found universal acceptance, and the book may serve as a guide for all who have to do with the care of trees.

The relation between the cost of pruning and the increased value consequent upon its operation will always be the point upon which the utility of pruning operations will

turn: that, of course, will have to be decided by each one interested, and for his individual case.

The Trees of Northeastern America, The Shrubs of Northeastern America, by Chas. S. Newhall. Published by G. P. Putnam's Sons, New York.

The popularity of these two manuals is evidenced by the fact that the *Trees of Northeastern America* has been printed twelve times, and the *Shrubs of Northeastern America*, four times. The books are still among the most convenient that we have for the identification of our eastern trees and shrubs, though in some respects their peculiar value has been eclipsed by later publications. The full-sized illustrations of the leaves and often of the flowers and fruit make identification of the species quite easy; while the keys that are supplied furnish additional means to the same end. The size of the books—a narrow octavo—is inconvenient, and does much to limit their usefulness. However, one who is interested in the study of our native silva and shrubby flora can scarcely get along without them.

First Report of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii. Period from July 1, 1903, to December 31, 1904. Pp. 170. Honolulu, 1905.

Considerable interest has been displayed in forestry in Hawaii since the visit of Mr. Wm. L. Hall, of the Bureau of Forestry, in 1903, and the appointment of Mr. Ralph S. Hosmer as Superintendent of Forestry in Hawaii in January, 1904. Two government forest reserves have been established since that time, and much information collected by detailed study of the forests of Hawaii—practically a new field for the forester. Of primary interest to our readers is Mr. Hosmer's report and the reports of his assistants, but there is also much interesting information in the book concerning agriculture in the "Paradise of the Pacific."

DEPARTMENT OF THE INTERIOR, Washington, D. C., October 5, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Chamber of Commerce Building, Denver, Colo., until 2 o'clock, p. m., November 8, 1905, for the construction of about 50 miles of main canal, involving about 3,000,000 cubic yards of earthwork and 130,000 cubic yards of rockwork, for the irrigation of lands in the North Platte Valley in eastern Wyoming and western Nebraska. Specifications, forms of proposals, and plans may be inspected at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., and at the office of the Reclamation Service, Denver, Colo., and Mitchell, Nebraska. THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, Washington, D. C., October 14, 1905. Sealed proposals will be received at the office of the Engineer, U. S. Reclamation Service, Billings, Montana, until 2 o'clock p. m., December 15, 1905, for the construction of main canal, laterals, and ditches, involving the excavation of about 640,000 cubic yards of earth, some rock excavation, and furnishing labor and material for various structures, requiring about 330,000 feet B. M. of lumber, 140,000 pounds of steel, and 1,400 cubic yards of concrete. Particulars may be obtained from the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or from Robert S. Stockton, Engineer, Huntley, Montana. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, Washington, D. C., October 6, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Chamber of Commerce Building, Denver, Colo., until 3 o'clock p. m., November 8, 1905, for the construction of concrete culverts, siphons, drops, flumes, waste-ways, bridge abutments, etc., and furnishing 10 combination highway bridges, and 570,000 pounds steel. Total amount of concrete about 10,000 cubic yards. Above work to be done along the line of the Interstate Canal from Whalen to Torrington, Wyo., in connection with the North Platte project, Nebraska. Specifications, form of proposal and plans may be obtained at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., or from John E. Field, Engineer, Reclamation Service, Denver, Colo., or Wyncote, Wyo. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, Washington, D. C., September 7, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Billings, Montana, until 2 o'clock p. m., December 5, 1905, for the construction of the Lower Yellowstone Dam, a rock filled timber cribbed structure, requiring about one-half million feet of lumber, 700 piles, 1,000 sheet piles, 11,000 cubic yards of rock filling and riprap, and 100 tons of steel, located about 18 miles northeast of Glendive, Montana. Plans, specifications and proposal blanks may be obtained from the Chief Engineer, United States Reclamation Service, Washington, D. C., or from Frank E. Weymouth, Engineer, Glendive, Montana.

THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, Washington, D. C., October 5, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Denver, Colo., until 2 o'clock p. m., November 1, 1905, for furnishing 10,000 barrels, more or less, of Portland cement, f. o. b. cars at stations on the Chicago, Burlington & Quincy Railroad (Guernsey Branch) between Torrington and Whalen, Wyo. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or to John E. Field, Engineer, Fort Laramie, Wyo. THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, Washington, D. C., September 21, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Glendive, Mont., until 10 o'clock a. m., November 15, 1905, for the construction of about 33 miles of main canal and about 74 miles of branches and laterals between Newlon, Mont., and Buford, N. Dak., involving the excavation of 1,587,500 cubic yards of material in the Fort Buford Project, North Dakota and Montana. Plans, specifications and proposal blanks may be obtained from the Chief Engineer, United States Reclamation Service, U. S. Geological Survey, Washington, D. C., or from Frank E. Weymouth, Engineer, Glendive, Mont.

THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, Washington, D. C., August 30, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Belle Fourche, South Dakota, until 4 o'clock p. m., October 26, 1905, for the construction of an earthen dam and appurtenances, and 17½ miles of canals, involving about 2,600,000 cubic yards of earthwork, 3,000 cubic yards of rock excavation, 24,000 cubic yards of concrete masonry and 45,000 pounds of steel and cast iron. The work is located about 12 miles northeasterly from Belle Fourche, South Dakota. Specifications and forms of proposal may be obtained from the Chief Engineer of the Reclamation Service, Washington, D. C., or from R. F. Walter, District Engineer, Belle Fourche, South Dakota. Plans may be inspected at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., or at the offices of the Reclamation Service, Chamber of Commerce Building, Denver Colorado, and Belle Fourche, So. Dak.

THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, Washington, D. C., September 9, 1905. Sealed proposals will be received at the office of the Electrical Engineer, United States Reclamation Service, 398 Pacific Electrical Building, Los Angeles, California, until 2 o'clock p. m., November 1, 1905, for furnishing complete, f. o. b. bidder's works, one or more alternating-current, 900-kilowatt, 25 cycle generators, one or more 100-kilowatt direct-current generators for exciter, and one switchboard containing one panel for generator and one panel for exciter, for use in the Roosevelt power house, Salt River Project, Arizona. Particulars may be obtained by application to the Chief Engineer of the Reclamation Service, Washington, D. C., or to O. H. Ensign, Electrical Engineer, 398 Pacific Electric Building, Los Angeles, Cal.

THOS. RYAN, Acting Secretary.

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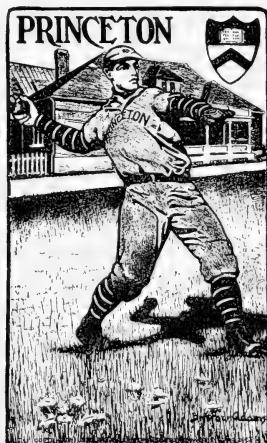
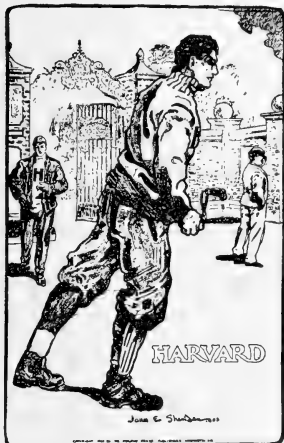
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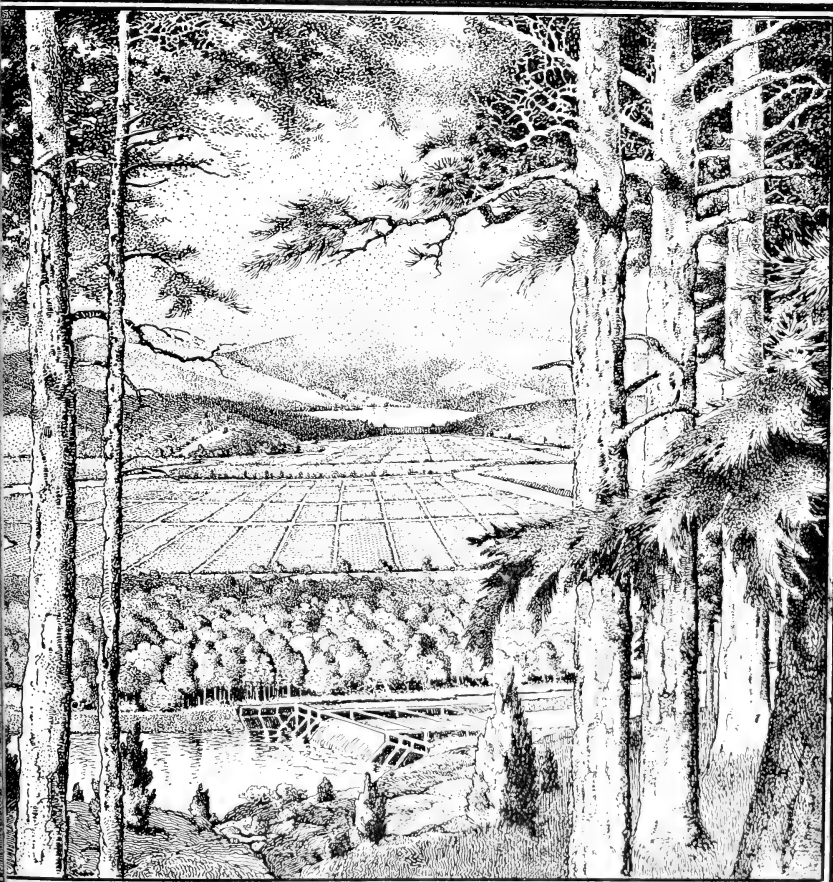
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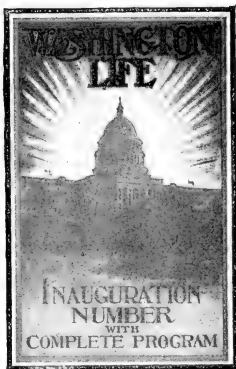
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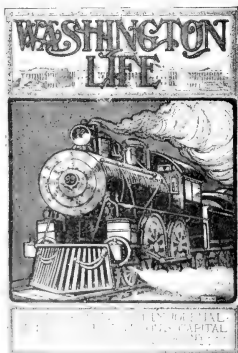
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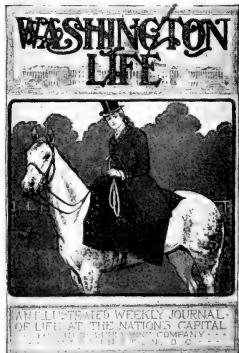


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Forestry and Irrigation

H. M. SUTER, Editor

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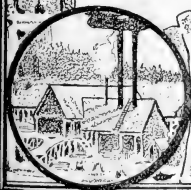
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THE BROOKS THAT DISAPPEAR WITH THE FOREST.
Scene in the White Mountains.

Forestry and Irrigation.

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NO. II

NEWS AND NOTES

Forestry In Nebraska

Fifty students are taking work in the department of forestry, University of Nebraska, this semester, and the enrollment in the courses in farm forestry to be given next semester will bring a total of about ninety under instruction in forestry this year. Some twenty-five are specializing in this subject. Three men expect to graduate from the full four-year course next June. It is very gratifying that the work has gone beyond the preparation of men for the profession, as students are beginning to elect certain courses in forestry because they wish to acquire a general knowledge of the subject, thus recognizing that forestry has come to have a rightful place in the university curriculum.

The University Forest Club, organized last year, meets every two weeks for the discussion of forestry questions.

Ranger Meetings

In order to encourage good work in the ranger corps on the forest reserves, supervisors will hereafter hold meetings from time to time, which the rangers will attend for the discussion of business relating to the reserves and the offering of suggestions for the best solution of the local forest problems. Such a meeting was held a few days ago on the Manti Reserve in Utah. The laws and regulations governing the use of the reserves and sales of timber were discussed, and suggestions were offered by which the demand for timber and for other resources might be met with the greatest advantage to the forest. The time of the meeting coincided with the visit of

Forest Inspector T. H. Sherrard. A greater *esprit de corps* and a more thorough and intelligent knowledge of reserve work will undoubtedly result from these meetings.

New Hampshire Forests

The study of forest conditions in southern New Hampshire which the Forest Service is making in co-operation with that state is rapidly nearing completion. Seven men have been engaged upon the work during the entire summer. This study supplements the one already made by the Forest Service for the forest conditions of northern New Hampshire.

In connection with this work, the agents of the service have completed a large number of preliminary woodlot examinations in response to applications made by farmers and other woodland owners in the region. Mill scale work has also been carried on with a view to discovering the comparative grades of white pine boards sawed from logs of various sizes. As the supply of white pine of large diameter decreases, the value of wide boards naturally rises, so that in calculating the return to be expected from a future crop the higher relative value of trees of large diameter must figure as an important factor. Furthermore, relatively more good quality material can be sawed from logs of the larger dimensions.

Study of Poles

Seven electric companies doing business in California have made arrangements with the Forest Service for a thorough co-operative study of seasoning and preserving telephone

and telegraph poles. The work centers at Los Angeles, and an agent of the Forest Service will immediately take up the preliminaries there.

Oregon cedar is the tree chiefly used in this region for poles. The experiments will be devoted not only to the handling of this wood, but to a search for satisfactory substitutes among other species. Possible substitutes are western yellow pine, incense cedar, redwood, and eucalyptus. The comparative value of these will be studied,

Los Angeles and Pacific Railway Company, the Pacific Railway Company, and the Los Angeles Railway Company.

Trails in Forest Reserves During the coming winter and spring many miles of trails will be built in the forest reserves. One of the chief cares of the Forest Service in the management of the reserves is to protect them against fire, and no means of controlling fires is so effective as preventing them. If a forest fire



Grand River Canyon, Colorado. looking up stream from above mouth of Rapid Creek.

and those which promise best will be subjected to such seasoning and preservative treatment as the Forest Service may recommend. In general, the wood will be handled in much the same manner as that which has proved successful in other work done by the service.

The companies which will co-operate with the Forest Service are the Pacific Light and Power Company, the Edison Electric Company, the Los Angeles Gas and Electric Company, the Home Telephone Company, the

can be reached soon after it begins, it is usually possible to extinguish it before much damage is done; but if it gets well under way it is sometimes impossible to put it out.

The trails that are to be built by the Forest Service will afford a means of reaching all parts of the forest reserves on horseback, and the fire lines will form vantage points from which the fire may be attacked, or against which it may be directed and there controlled.

There are already many miles of trails in the various reserves, but most of them are rough, in poor condition, or not passable for horses. The trails to be built will be carefully planned, and constructed with an easy grade. This does not involve much expense, for in many situations a perfectly good trail can be built for \$20 a mile, and many miles will cost less than \$5. The work will be directed by the regular forest officers, and the rangers themselves will perform most of the labor. There is no question but that these trails will prove of inestimable value in protecting the forest reserves. Many of them will also be worth as much more in making regions accessible to hunters and prospectors which are now almost entirely beyond reach.

Planting On Coal Lands Mr. S. N. Spring, of the Forest Service, who during the past summer made a regional forest study of the coal country in southwestern Pennsylvania, eastern Ohio, and northwestern West Virginia, has gone to Scottsdale, Pa., to prepare a forest planting plan for lands of the Frick Coal Company, which has called upon the Forest Service for co-operation in planting forest trees on lands over coal mines, the value of which for agriculture is so slight that their improvement by a crop of trees is sought as a means of revenue.

This region belongs naturally to the Western Appalachian forest belt, but the mining industry has stripped the land of trees, and mine owners in many cases must choose between leaving their coal lands quite barren and increasing their value for use or sale by the raising of tree plantations of commercial species.

Sale of Reserve Timber A sale has been made by the Government Forest Service of approximately 50,000,000 feet of dead and insect-infested western yellow pine timber in the Black Hills Forest Reserve in South Dakota and Wyoming to the McLaughlin Tie and Timber Com-

pany. The contract regulating the logging has been agreed upon, and the cutting of the timber, for which the Government received approximately \$37,000, is about to begin.

The timber is situated in the northwestern part of the reserve, extending from the Chicago, Burlington and Quincy Railroad westward across the South Dakota state line into Wyoming. In order to remove it, a logging railroad will be constructed.

Treating Telephone Poles An agent of the Forest Service has just returned to Washington from Pocahontas county, West Virginia, where the Postal Telegraph-Cable Company has established a camp for the cutting and treatment of chestnut telephone poles. The co-operation of the Forest Service was asked by the company to devise methods of seasoning and handling poles. The recommendations for seasoning, which have already been made, have been adopted by the company.

A number of poles will be soaked in water for about thirty days, to hasten seasoning. Other poles will be air-seasoned without soaking. The value of soaking will be demonstrated by a comparison of the results of these two methods.

Reforestation Water Sheds A lease which gives the Forest Service full rights to a forest nursery site in the San Marcos Pass, in the Santa Barbara Mountains, has just been executed. Work has been going on at this station since March; a lath house has been erected, and about 250,000 young trees are growing in seed beds. This is the fourth tree-planting station to be established by the service, and promises to be one of the most important ones. The greatest need of the city of Santa Barbara is more water, and the progressive citizens have taken definite action to secure an unlimited supply from the Santa Inez River, in the Santa Barbara Reserve. A dam will be built in Mono Basin, and the water carried

under the Santa Inez Range to Santa Barbara by means of a tunnel. The watersheds supplying this dam are practically barren of trees, and are either entirely denuded or covered with chapparal, which does not hold the flood waters or prevent the movement of silt. The planting operations of the Forest Service will at the beginning be concentrated on the reforestation of this important basin. The seeds of several hardy trees, including the knobcone, Coulter, western yellow, and Monterey pines, bigcone spruce, incense cedar, and Himalyan cedar, will be planted in the San Marcos nursery and the young trees will be cared for until two or three years old, when they will be finally transplanted to the planting sites which have been selected on the mountain slopes.

Woods For Vehicles.

The study of woods used in vehicle manufacture, which is being carried on by the Forest Service, is one in which manufacturers are keenly interested. An agent of the Forest Service who has been assigned to the work has so far visited nearly one hundred manufacturing plants where buggies, wagons, farm implements, automobiles, and wheelbarrows are made.

The question of woods for boxes was found to be a vital one to the wagon manufacturers. Poplar and cottonwood have reached a price which almost prohibits their use. Poplar is expected to rise yet higher, and the manufacturers will then be forced either to use other material or to raise the price of their wagons. The rigid grading which manufacturers place on poles and shafts makes it difficult to meet the requirements for wood for these purposes, and it is said that unless the grading is broadened timber for poles and shafts will soon fall behind the demand. The strict specifications of white oak for wagon-pole stock has already weakened, and red oak is being largely used in its stead. Birch is slowly gaining favor for hub manufacture, taking the place of white oak, the excessive checking of which

is said to occasion considerable loss to the manufacturers. Red gum is gradually gaining a place for itself for use in various parts of buggies, sleighs, automobiles, and other like vehicles.

In the implement trade longleaf pine has practically replaced red oak, and shows a strong tendency also to supersede white oak as well. Red gum, in combination with western spruce or red fir, has entered into this line of manufacture for panel work.

Fire Fighting Successful

How successfully a well-trained and efficient ranger force may fight dangerous forest fires is well shown by the achievement of Supervisor Slosson and his rangers in putting out the recent forest fire in the Santa Barbara Forest Reserve in southern California. This fire broke out the first week in October and was quickly reported to the supervisor. A strong wind blew the flames into the reserve and made the work of the fire-fighters extremely difficult. For several days the fighting force under the supervisor and his best rangers fought the fire with great energy and skill, until it was at last extinguished.

The fire was reported by two rangers, who rode thirty miles to bring the news. The wind is said by residents to have been the most violent in years. Within three hours the fire had traveled four miles along the south border of the reserve and south of the reserve. Meantime, another large fire was reported from Nordhoff, but this was prevented from entering the reserve by the diligence of rangers stationed at that point, who secured help from the nearby settlements. Within the reserve the constant work of the supervisor and rangers was required from October 7 to October 17. Mr. Slosson is said to have collapsed when it was assured that the reserve was safe. The efficiency and devotion to duty of the reserve officers in fighting and extinguishing these fires has called forth congratulations from the Forester.

Close of Forest Exhibit Mr. George B. Sudworth, dendrologist of the Forest Service, has just returned from the Pacific Coast, where various important official duties have claimed his attention, among them the closing of the Forest Service display at the Lewis and Clark Centennial Exposition, Portland, Ore. A large amount of valuable forest exhibit property — transparencies, models, forest instruments, etc.—is being returned to Washington for safe-keeping and for future use by the service.

Mr. Sudworth reports that the Government forest exhibit at Portland was from all points of view the most successful one undertaken by the Forest Service. More, perhaps, than any other part of the United States, the Northwest took the keenest sort of interest in the effort made by the service to point out the peculiar local forest problems and to bring before the people of that section the importance of early adopting a conservative utilization of its enormous but inexhaustible timber wealth.

A large part of this display will be lent to the New England Forest, Fish, and Game Association, which gives its annual exposition in Boston, Mass., during the last week in December.

Another matter which has received attention was the inspection of investigation that the Forest Service is conducting in California and the arid Southwest of desert pines, acacias, and eucalypts, for the purpose of determining the greatest usefulness of these drought-enduring trees in sections of the country where trees are scarce or entirely wanting.

Woods for Cooperage The study which the Forest Service is making of the woods used in the cooperage industry is receiving much encouragement among manufacturers. In the northern states an agent of the service is devoting his chief attention to slack cooperage stock, and in the southern states another agent is working upon the stock used in tight cooperage. Excellent op-

portunity has been afforded both men for experimental work, and they are making some very interesting tests at various plants to determine the number and grade of staves produced by logs of different diameters. The study of box and basket woods has progressed so far that data have been secured for these woods in New York and New England. An agent of the service addressed a meeting of the National Association of Box and Box Shook Manufacturers at Niagara Falls recently, and has had a conference with the chairman of the committee on forestry appointed by the association. As a result of this conference, it is hoped that experimental work of practical value to box manufacturers will be undertaken and completed.

Planting Plans by Forest Service Owing to the large number of applications received from timberland owners who desire to apply conservative principles on their lands in the South, the Forest Service is preparing to devote much attention to this work during the coming winter. Its agents will visit most of the southeastern states, and those desiring to have examinations made with a view to securing the co-operation of the service in forest work should apply at once, since winter is the best season for work in this region, and the presence of agents on the ground will enable the service to give prompt attention to such applications.

An agent of the Forest Service will next week go to Florida with three assistants, to make preliminary examinations of several large tracts in that state. One of these, in Lee county, comprises over 700,000 acres. Applications for other large tracts, aggregating over one million acres, have already been received.

Educational Campaign in Forestry The general practical success of farmers' institute work along agricultural lines has indicated a new line of work for the Forest Service in bringing the attention of the farmers of the

Middle West to the benefits and possibilities of forest planting. It is proposed to have a series of lectures on forestry given during the winter at the farmers' institutes in Nebraska. The lectures will indicate briefly the steps which should be taken in planting windbreaks and woodlots, call attention to the trees which will serve both for protection and as a source of timber supply, indicate how the plants can be grown at home if desired, and explain the cultural methods which

value of the stream waters in the state are rapidly nearing completion. The work is being formed under a joint appropriation, the California part of which was authorized by the state legislature at the last session.

It was long since noted that the water in California's streams is somewhat peculiar in that its character varies from season to season and often from day to day. Therefore infrequent analyses do not afford results upon which dependence can be placed. A



View of gorge below Elephant Butte, New Mexico, showing dam site looking down stream.

should be given them. In the past, many short-lived and worthless species have been planted, and it will be the aim in this work to call attention to such short-sighted policy and to make recommendations for the better selection of species.

Examination of Stream Waters Arrangements for cooperative work between the U. S. Geological Survey and the State of California to determine the character and economic

value of the stream waters in the state are rapidly nearing completion. The work is being formed under a joint appropriation, the California part of which was authorized by the state legislature at the last session. It was long since noted that the water in California's streams is somewhat peculiar in that its character varies from season to season and often from day to day. Therefore infrequent analyses do not afford results upon which dependence can be placed. A

tionable. In such cases it will be found necessary only to store at the head of the stream the flood water, and thus there may be secured to cities in the state water supplies of good quality at considerably less cost than has up to this time been reckoned upon.

The co-operative investigations are to be under the immediate direction of Mr. M. O. Leighton, hydrographer, U. S. Geological Survey, who will be assisted by Mr. C. H. Stone, analyst, and Mr. F. M. Eaton, hydrographic aid of the Survey laboratory at Berkeley. The following is a list of rivers and points at which permanent gaging stations are to be established and from which samples are to be sent daily for examination:

Malibu River at Calabasas, Santa Ynez River near Santa Barbara, Arroyo Seco near Salinas, Santa Maria at Santa Maria, Boulder Creek above Santa Cruz, San Luis Rey at Pala, Santa Ana River at Warm Springs, San Bonita River near Hollister, Kern River near Bakersfield, Merced River at Merced Falls, Tuolumne River at La Grange, Stanislaus River at Knights Ferry, Mokelumne River at Clement, San Joaquin River at Tracy, Sacramento River at Sacramento, American River at Sacramento, Feather River at Marysville, and Alameda Creek at Niles.

The actual sampling from the above points will commence on January 1, and be continued through the fiscal year of 1906.

Situation In Pecos Valley A most deplorable condition exists in the Pecos Valley near Carlsbad, New Mexico, which is set forth in resolutions passed at a meeting of the Carlsbad Commercial Club and forwarded through the chief engineer of the Reclamation Service to the Secretary of the Interior.

About 18,000 acres of irrigated land tributary to Carlsbad and dependent for water upon the Pecos Irrigation Company, have been without water

since the disastrous floods of 1904 carried out the dam and other works. The result as recited in the resolutions, has been the death of shade and fruit trees and vines, the total failure of crops and great financial loss. Unless the Avalon dam is rebuilt the property situated under this canal system, including the town of Carlsbad, the county seat, and amounting to between two and three millions of dollars, is threatened with total extinction.

The engineers of the Reclamation Service, at the urgent request of the people interested, have made detailed examinations and surveys and perfected plans for the relief of the settlers, subject to the approval of the Secretary of the Interior.

It is hoped that it will be possible for the government to take over the works of the Pecos Irrigation Company and construct a permanent system for the irrigation of the lands now under water, and an additional acreage, but this action may be impossible on account of the limited condition of the reclamation fund, and the legitimate demands upon it in other localities. The department is assembling data upon all the projects in the arid region, and until these are taken into consideration it is probable no action can be taken in the matter.

Projects for Washington

Prospects are bright for the early construction of two irrigation projects in the State of Washington by the Federal Government. Field parties have been actively engaged making surveys throughout the state during the season, and at recent meetings of consulting boards of Reclamation Service engineers to consider plans and estimates, two projects were favorably recommended, viz: the Okanogan project in northern Washington, and the Tieton project near North Yakima.

The Tieton project contemplates the irrigation of about 24,000 acres of land in the Yakima Valley by water taken from the Tieton River. The natural flow of the stream in the vicinity of the

proposed system is sufficient for the requirements of the project and for the only canal taking water from the river, but in order to satisfy existing rights below the mouth of the Tieton River it will be necessary to provide storage for about 50,000 acre-feet of water, and suitable reservoir sites have been located in Bumping Lake, on the headwaters of Natches River, and in either Lake Keechelus, Kachess or CleElum, on the headwaters of Yakima River.

The land to be irrigated is of excellent quality and well adapted to the production of such high priced crops as fruit and hops, which are now being produced in large quantities on adjoining land. On account of the possibilities for high development it is probable that the farm unit will be small and that the land would easily bear a considerably higher cost than the estimated price of water right, which is \$55 per acre.

Tieton Project Feasible

The Yakima Commercial Club, of North Yakima, Washington, has transmitted to the Secretary of the Interior a set of resolutions which emphatically set at rest some false and misleading reports which have been circulated regarding the feasibility of the Tieton project in that valley and its ability to repay the government the sum of \$55 per acre, the amount estimated by the board of irrigation as the pro rata cost for the construction of a national irrigation work.

In the resolutions it is stated that the area to be reclaimed under the proposed canal is comprised almost entirely of rich uplands, the soil being the fertile volcanic ash; that these lands, owing to the nature of the soil and their location, are essentially high class fruit lands, to which purpose the major portion would undoubtedly be put after being reclaimed.

The transportation facilities are good and the markets are excellent. The lands now under irrigation in the vicinity readily command prices ranging from \$150 to \$500 per acre, based

upon the productions of the soil in this district. The resolutions recite that the early reclamation of these lands is a public necessity from the standpoint of this community. The irrigated lands in this portion of the great Yakima Valley are or soon will be cultivated up to their full capacity. As a result of excellent market and a steady influx of new settlers from other sections, the cultivated lands are gradually but surely getting beyond the reach of the home-seeker with limited means.

It is positively denied that the lands under this project are held almost in their entirety by speculators. A large percentage of the total is held by claimants under the homestead and desert land acts; the balance is owned by individuals, all local men. Both the claimants and individual owners are willing to enter an agreement to subdivide their holdings into the regulation farm units and sell the surplus at reasonable prices to settlers.

The Gunnison Tunnel

Since the failure of the original contractors on the Gunnison tunnel to comply with the requirements of the government, and the rejection of second bids for the work, the excavation has been in charge of the engineers of the Reclamation Service and the work is being done under force account.

Advices received from Supervising Engineer J. H. Quinton, at Montrose, indicate that rapid progress is being made on the work. On November 1st the tunnel heading from the Gunnison River was in 2,000 feet, and the Cedar Creek heading 2,700 feet, making a total of 4,700 feet.

The Gunnison tunnel, which is to be completed in 1908, will be 30,000 feet in length, the longest tunnel in the United States. It will be 10½ by 11½ and will carry a very large volume of water from the Gunnison River through a mountain divide 2,000 feet in height into the Uncompahgre Valley, where it will be utilized for the irrigation of about 50,000 acres of exceedingly fertile land.

OUR EASTERN FORESTS

BY

REV. DR. EDWARD EVERITT HALE

Chaplain of the United States Senate

AS the first session of the new Congress approaches, the attention of every part of the country should be called to the various proposals which the National Forest Service and the various forestry boards of the several states have prepared. It will be as well if every citizen can remember that such study and action as are proposed are exactly what western Asia and northern Africa needed when their decline began. Because no such action was taken, because the forests of Asia Minor and of Syria and of northern Africa were destroyed, those lands are what they are. President Roosevelt, in his address at Raleigh, N. C., called attention to this failure of those countries, and he gives also the instance of China, an immense empire which owes its present desolate condition to the destruction of its forests. The nations around the Mediterranean were the center of the civilization of the world. No cities were more prosperous than theirs, no people were more proud or successful. And now, what were rivers then are but winter torrents, what were cities then are straggling villages.

A generation ago, when the American Forestry Association was formed, Dr. George Bailey Loring, the head of the Department of Agriculture, said that he regarded the formation of that association as the most important movement which the American people had started in those years. Thirty years have justified his statements and prophecies. Indeed, the increase of our dangers has awakened men from the indifference in this matter which marked the middle of the last century. As the readers of this journal know, everyone who joined in the great conference at Washington last January,

who saw that assembly or who heard the addresses made there, knows now that a general national interest has been awakened in the preservation of our forests. Railroad men, water-power men, representatives of half a dozen great industries, met together in the same great interest.

What is especially important to be remembered now, is the condition of forests, not in the Rocky Mountain watershed, but in that of the Alleghany and the ranges eastward.

Nothing shows the generosity of the nation more than the magnificent provision which it has made for what was the Louisiana of the French, which is now that half of the United States west of the Mississippi River. In every state in that region, and in every territory, the general government has already established a magnificent forest reserve—in some instances more than one.

Nothing shows the lavishness of our generosity and the indifference of the majority to merely local selfishness more than the fact, which is itself curious, that on the east of the Mississippi, to the Atlantic ocean, there is no such reservation. At this moment the government is expending more than \$20,000,000 for the proper irrigation of the arid regions of the West. But at this moment the general government is not expending five cents for the regulation of the irrigation of the Old Thirteen States, or of the states born from them east of the Mississippi River.

Yet the injury inflicted upon commerce, upon travel, upon manufacture, and upon agriculture, by the destruction of the forests of the eastern half of the continent will be, for a hundred years at least, greater than injury to

the kindred interests in the western half. And these are injuries which affect the whole nation. The farthest state on the Pacific is injured if the Pennsylvania Railroad between Philadelphia and Pittsburg is injured, the man who wears a flannel shirt in Montana is injured when the woolen man-

to say that the preservation of that water power should be left to the legislation of the State of New Hampshire, to which the town of Holyoke does not belong? The water which drives the mills at Holyoke comes from the forests of New Hampshire, of Massachusetts, and of Vermont. The paper and



A Primeval Spruce Forest in the White Mountains

ufacture of Lawrence or Holyoke is injured. Take that special instance: the water power at the city of Holyoke is said to be the second water power in the United States. The water power of Niagara comes first, and the next power among those developed is the power at Holyoke. Is it not absurd

other fabrics which are made at Holyoke go over the world. As I said, the ranchman in Montana feels an injury in Holyoke, and the nation to which that ranchman belongs, one might say, owes a debt to Holyoke. Speaking simply, the whole matter of water-flow is a national and not a local affair.

They found this out so soon as men settled in Idaho, in Wyoming, and Montana, and in other states which are called "irrigation states," of the western half of the continent. But it is just as true of Rhode Island, of New York, of the Carolinas, and of Tennes-

shall necessarily make one connected territory, but it is proposed that the national authorities shall control the cutting of timber there. This can only be done if the nation holds the property as the King of Prussia holds such property in the Prussian forests or the



Logging the Steep Slopes in the White Mountains

see, as it is true for Idaho, Wyoming, and Montana.

It is now proposed that a considerable body of land shall be reserved in the highlands of the Carolinas, of Tennessee, of Virginia, and perhaps of Kentucky, where the nation shall make sure that the forests are not destroyed. It is not proposed that these holdings

King of Bavaria holds the property in the Bavarian forests. There is ample experience which shows that the national investment in such forests will produce a steady revenue quite sufficient to justify such expenditure, even if it were regarded simply as an investment. In the case of Prussia, for instance, in the year 1902, after the

forests had paid for their national administration by the state, they paid into the general treasury of Prussia, as a part of the annual revenue, 56,000,000 marks.

But the results of the control of the American forests is sought, not for a poor matter of revenue, but as a matter of policy extending forward, if you please, for a hundred years.

The necessity in the case of the White Mountain Reservation is even stronger. The present processes of lumbering strip every inch of the country of every shrub and tree which is larger than a blackberry bush. This means that in the snows of winter and the consequent freshets of spring the soil itself is carried away. The harvest from that soil in the year 2,000, if you carry them on in such recklessness as now reigns, will be a harvest of blackberries instead of a harvest of white pine. You cannot sit back in your chair and say that the twenty-first cen-

tury may take care of itself. On the other hand, you are making sure that the twentieth century shall not take care of itself. You are making it impossible to reproduce the magnificent pine forests which once covered the Presidential Range.

The proposal which will be definitely brought before the new Congress is a provision for the gradual purchase of the Appalachian Reserve at the South and of the New Hampshire Reserve around the White Mountains. The New Hampshire Reserve as surveyed by an intelligent commission under the direction of the United States Forest Service, might amount in the whole to fifty square miles. No possible expenditure could be of greater benefit, not simply to the states of New England, but to the nation. And everyone must see that such preservation and cultivation as is proposed is much safer in the hands of the national authorities than it would be under any local charge.

WATER POWERS OF THE SOUTHERN APPALACHIAN REGION*

BY

H. A. PRESSEY

Hydrographer, U. S. Geological Survey

THE Southern Appalachian Mountains, located in the States of Virginia, North Carolina, South Carolina, Tennessee, Georgia, and Alabama, stand out from and above the surrounding country as an elevated physiographic unit. They rise above the Piedmont Plateau, which borders them on the east and south, and above the valley of East Tennessee, which lies on their western flanks, to a height of from 2,000 to nearly 6,000 feet above sea level.

This is pre-eminently a region of mountains. The slopes are mostly covered with deep soil, which is kept in an open, porous condition by the humus that enters into its composition and is spread over the surface, and which is held in place by the myriads of roots of trees and shrubs and grasses growing upon it. In this region the raindrops are battered to pieces by the twigs and leaves and the water is caught by the grasses, shrubs, and ferns below and soaks through the

*NOTE.—This article is based on data collected during the field seasons of 1900 and 1901, and included in a report to Congress on Forest Conditions in the Southern Appalachian Mountains.



The Gorge of The Linville River Across The Blue Ridge.
On these steep rocky walls are forests which should be preserved forever.

covering humus into the soil and rock fissures underneath. The portion that is neither used by the vegetation nor evaporated from the surface emerges about the mountain slopes weeks or months after its fall in countless springs that feed with striking regularity the many brooks, creeks, and rivers which thus have their sources here. These conditions combine to make this one of the best watered regions on the continent.

This region embraces an irregular, mountainous tableland, lying between the steep and well-defined escarpment of the Blue Ridge on the southeast and the less rugged, but higher and more massive Unaka chain on the northwest. Numerous cross ridges separated by narrow valleys and river gorges connect these two ranges or extend out between them. The region, taken as a whole, has an average elevation of more than 2,500 feet, but there are many peaks that rise to about 5,000 feet, and a considerable number to over 6,000 feet. The mountain slopes, though usually steep, are forest covered, and have a deep, fertile soil of varying physical character, which is very readily eroded and washed away when the forest covering is removed. The Blue Ridge, though not so high as the mountains to the west, is an older range and constitutes the divide between the waters flowing to the east and those flowing to the west, the streams flowing in either direction having their head springs in or near the gaps of this divide.

In considering the Blue Ridge as the great divide of this region two portions of it are especially notable. Near Grandfather Mountain, the highest point on the Blue Ridge, the New or Kanawha River rises and flows northward through Virginia and thence northward into the Ohio; the Yadkin rises a few yards distant on the east and flows northeast and then southeast into the Atlantic; the Linville, a branch of the Catawba, rises on the west side and flows south-southeast, cutting across the Blue Ridge in a deep gorge,

while a few miles farther west the Watauga and Nolichucky flow northwest and southwest, respectively, into the Tennessee and the Gulf. One hundred and fifty miles farther southwest, where the Blue Ridge is somewhat broken up near its junction with the Balsam cross ridge, the French Broad rises and flows eastward; the Saluda flows southeast; the Savannah south, and the Tuckasegee west-southwest, into the Tennessee.

The most striking characteristic of the Blue Ridge is the great apparent difference in height when viewed from its two sides, the streams flowing toward the east plunging down its sides in narrow V-shaped gorges for a thousand feet or more in a distance of a few miles until they reach the gentle slopes of the Piedmont Plain. Those flowing westward have a much easier descent.

This is well shown by the great falls on the Linville River, which, rising on the western slopes of Grandfather Mountain, in Mitchell county, flows in a general southerly course to its junction with the Catawba River, near the southern end of the Linville Mountains. The falls proper, which are located about 3 miles below the Mitchell-Burke county line, have a perpendicular plunge of 40 feet, and the cascades above are about 50 feet in height, this fall of 90 feet occurring in a linear distance of about 100 feet. For a distance of about 10 miles below the falls the river flows in a series of cascades through a narrow gorge, whose sides are from 500 to nearly 2,000 feet high, the walls being cut down through the eroded Linville quartzites into the granite below. In the first six miles below the falls the descent averages 208 feet to the mile, and the total descent from the head of the falls to the lower end of the gorge, a distance of about ten miles, is 1,800, as determined by a line of levels. Along the upper six or seven miles of this distance the bottom of the gorge is scarcely wider than the stream. The total fall of the stream from its source in

Linville Gap to its mouth is about 3,030 feet in a distance of about 36½ miles, the average fall per mile being about 83 feet.

The Wautauga River also rises near Linville Gap, and flows first in a northeasterly and then in a northwesterly direction, its length from its source to Butler, Tenn., where it leaves the mountainous region, being about 33 miles. The total fall in this distance is about 2,000 feet, and the average slope, therefore, about 61 feet per mile. Of this 2,000 feet, between 900 and 1,000 feet are found in the first 6 miles, where the stream rushes down the slopes of Grandfather Mountain.

As is the case with most of the other streams rising on the western slope and flowing westward across the elevated plateau, this stream has its channel for a part of its course in a rather broad and smooth valley before entering the steep and rocky gorge of its middle course. Here it cuts its way through the Unaka Mountains in a deep canyon, about 8 miles in length, where the fall averages about 65 feet per mile, but is very much greater at numerous places, the channel being extremely rough and broken. The depth of the gorge through the Unakas is nearly 2,000 feet, but the walls slope down much more gently than those of the Linville just described, though they often show precipitous rock cliffs several hundred feet in height.

The Unaka range on the western edge of this plateau, unlike the Blue Ridge, has slopes equally steep on both sides, descending often some 4,000 feet from the crest of the mountains to the stream beds. In the upper part of their courses all of the rivers of the Unakas partake of the nature of mountain torrents, with the greatest fall near their sources, and in their lower courses they flow in valleys where there has been much clearing, the amount of water increasing rapidly at the time of rain on the mountain sides. In many parts the stream valleys are simply mountain gorges, with steep, vertical sides, and with very small

flood plains. Water powers could be developed at many places along these rivers, the fall in the upper part reaching, in some cases, 100 feet in an almost vertical drop, though the quantity of water at these points is comparatively small. When the rivers reach the plains lying at the edge of the mountain system their fall is very much less, yet at frequent intervals decided drops occur, and the flow is so increased by the numerous tributaries that water powers of considerable magnitude and value can be developed.

THE RAINFALL AND RUN-OFF IN THIS REGION.

In this region the influence of elevation on climate is supreme; the summers are colder, the winters more severe, and the climate is drier and more salubrious than at points not far distant, but outside of the high mountain area. The trend of the mountains to the southwest influences the prevailing winds, while the great diversity in topographic features gives rise to many interesting climatic peculiarities.

On the mountains near the southern end of the Appalachian system the rainfall is very heavy, but, on the other hand, in many central valleys the rainfall is as light and the climate as mild as at many points east of the Blue Ridge.

The area embraced in the proposed reserve belongs to that portion of the eastern United States characterized by the greatest annual rainfall, there being places along the southeastern slopes of the Blue Ridge which receive an annual precipitation not exceeded elsewhere in the United States, except along the northwest Pacific Coast. The average rainfall for a period of more than ten years at various places in the southern Appalachian Mountains in northern Georgia and western North Carolina and South Carolina has been nearly 73 inches, while at times the precipitation for a single month has been between 20 and 30 inches, the greatest amount falling in the three summer months and the least in au-

tumn, the amounts in winter and spring being about the same. It is worthy of remark that the average precipitation at Asheville is only about 42 inches—the smallest rainfall record made at any station in the region.

The entire region is characterized by extremely heavy rainfall in very short periods of time, and owing to the steep slopes and the absence of lakes, ponds, or marshes, which could act as reservoirs and hold back the storm waters, protracted heavy precipitation is followed by a rather rapid increase in the flow of the streams, the rise lasting generally for only a few hours, and the stream soon assuming its normal stage of flow. This is more especially the case where there are forest clearings. Consequently these violent rains, under certain conditions—*i. e.*, where rains are excessive and clearings extensive, or where forest areas are burned over so as to destroy the humus and undergrowth—give rise to floods which are very destructive to property and which cause occasionally the loss of human life. To a certain extent the forest acts as a reservoir, for it keeps the soil porous, allows it to absorb and hold the water for a time, and gradually gives it forth in the form of springs and rivulets. Where the areas have been deforested, however, the rain water forms small but swift-flowing torrents down the sides of the mountains, and quickly reaches the streams below. Deep channels are cut in the mountain sides, and all of the top fertile soil is carried off, leaving only the underlying clays, which are of poor quality and do not yield to cultivation.

After a storm the streams rising in the deforested areas are extremely turbid with mud from the mountain sides, while those from the forest areas are comparatively clear. This erosion can be noted by the most casual observer, and it forms one of the greatest menaces to the region. The soil is fertile and deep, as is shown by the splendid growth of forest trees and by its yield under the first cultivation, but it is

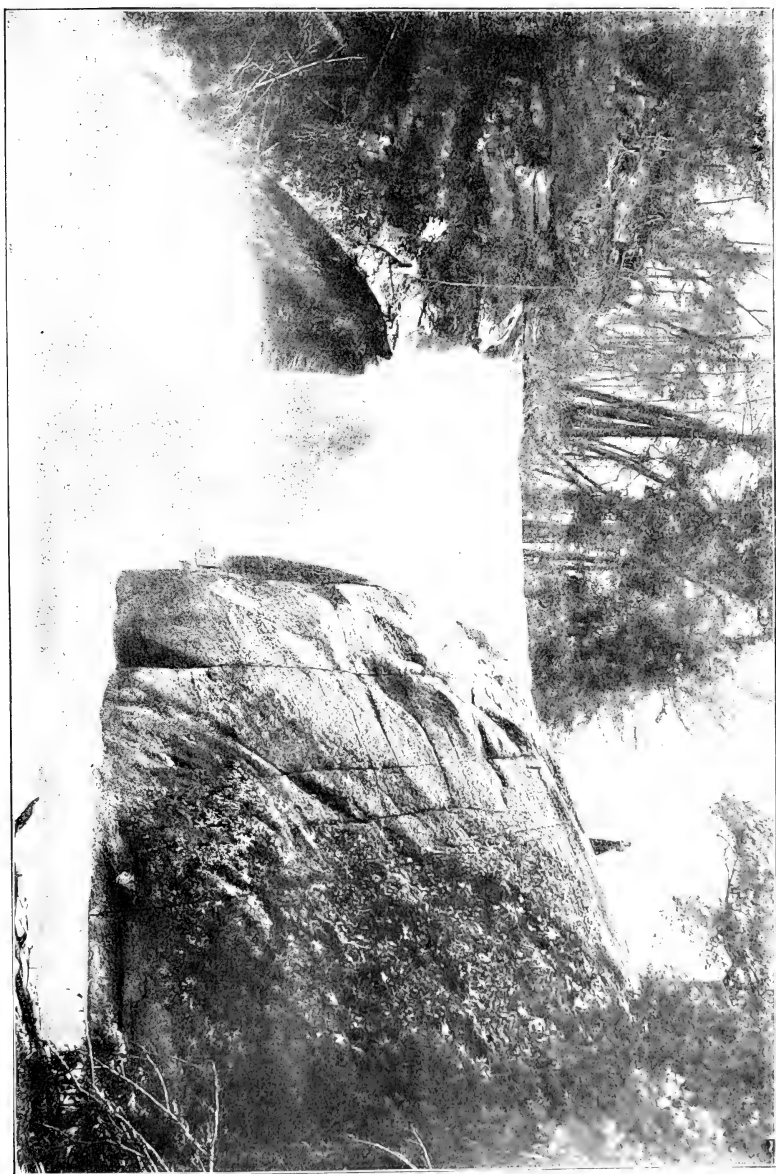
only a question of time, if the forests are wantonly cut, when all of the soil and vegetation will be washed from the mountain sides and nothing will remain but the bare rock.

These floods, due to protracted rains, are also destructive in strips of valley lands bordering the streams in the mountain region and in the wider valleys along their courses across the lowlands beyond. Bridges, mills, settlements, public roads, dams for developing water power, indeed, everything in the course of such a mountain stream is liable to be swept away by its rapidly increasing force.

During the spring of 1901 this region was visited by the most severe rain storm of its recent history. Many of the streams rose to unprecedented heights, and the flood damages to the farms, bridges, and dwellings on or near practically all of the streams flowing from these southern Appalachian Mountains, were enormous. During the summer season later floods added largely to this destruction.

Along the valley of the Catawba River in its course across the two Carolinas, these flood damages to farms, bridges, highways, buildings, etc., during the high water season of 1901, aggregated nearly two million dollars. The storm damages during the same season along the tributaries of the James, the Roanoke, the Yadkin, and the Broad, in Virginia and North Carolina, added a million dollars; and those on the tributaries of other streams rising about the Blue Ridge in South Carolina and Georgia add still another million, making four million in all for the streams flowing from the Blue Ridge across the Piedmont Plateau. Add to this the damages along the streams flowing out of the southern Appalachian Mountains to the north, west, and southwest, and we have another and a larger story of destruction:

On the New (Kanawha) and other smaller adjacent streams in Virginia and West Virginia, \$1,000,000.



On the Watauga, in North Carolina and Tennessee, \$2,000,000.

On the Nolichucky, in North Carolina and Tennessee, \$1,500,000.

On the French Broad and Pigeon, in North Carolina and Tennessee, \$500,000.

On the Tuckasegee, Little Tennessee, and Hiwassee, in North Carolina and Tennessee, \$500,000.

On the tributaries of western Georgia and Alabama streams rising in this region, \$500,000.

This aggregate of \$10,000,000 tells a story of destruction never before equalled in this region. Bridges were swept away by the score; houses by the hundred; thousands of miles of public roads were washed away almost beyond the possibility of repair. The soil in the narrow, irregular, fringing valley lands in the mountain region was in many cases partially and in other cases completely washed away. In the lowlands beyond, the broader bordering valleys were denuded beyond recuperation. Some areas were denuded of soil, while others were covered with desert-like, almost barren white sand extending for miles along the course of a stream.

But while the damage from the storm of 1901 exceeds that of any preceding year, it is common knowledge among the mountaineers that annually the floods have risen irregularly but steadily higher, and that their destructive work has been increasing in proportion as the forest clearings and the forest burnings have proceeded. We may confidently expect that floods of the future will exceed those of the past.

Many of these streams have fine water powers along their courses, the value of which is limited by their low-water flow. Deforestation means the destruction of the only source of natural storage in the region, and that the rainfall will reach the stream almost as soon as it falls, so that in the dry season there will be no reserve supply to augment the low-water flow, which is drawn principally from the sub-sur-

face sources. These water powers are a potential source of prosperity to the region in which they are found, and since their value depends entirely upon the water available, anything tending to reduce its amount or to change its distribution by increasing the violence of the floods and at the same time diminishing the low-water flow, will work injury in precise proportion to the change produced. This result is inevitable upon the deforestation of the drainage basin, and on many of the streams has already become evident. It is the general testimony of the older inhabitants of the region that the streams are now much more irregular than they were before active and widespread clearing operations had been begun. And while the evidence of the "oldest inhabitant," as an individual, may not be quite all that can be desired, collectively it is entitled to large credence. Already 24 per cent of the total area of this region has been cleared of its forests.

Lumbering operations are at present rather widespread, and the forests in many regions already begin to show evidence of their effect. The large mills are usually steam saw-mills, to which the logs are either transported by a system of tramroads radiating from the site of the mill, or, where the mill is located near a stream of sufficient size, the logs are brought down by splashing. A number of small saw-mills have been erected which make use of the abundant water power furnished by the various streams. These are, as a rule, of small capacity, from 500 to 1,000 feet per day, and do mainly the custom sawing for the region near by. In addition to these there are numerous small saw-mills owned for the most part by some firm holding extensive tracts of forest, and these are moved from place to place as the nearby timber becomes exhausted.

In any case the effect of the saw-mill on the forests is the same. All the trees available for use in any manner are cut into plank, and the careless methods destroy the greater part of

the young growth, which would otherwise in course of time replenish the supply. The logs when cut are "snaked" downhill by mule team, soon cutting a deep channel in the earth, which the waters from the first rain-storm turn into a yawning gully that rapidly spreads in extent. The tops and those parts of the trunk unsuitable for lumber are left on the ground to furnish fuel for the first fire or a breeding place for insects destructive to tree life.

In addition to the lumbering operations, the tan-bark industry is making great inroads on forest growth. Every year thousands of cords of bark are stripped in these mountains, and each load means that some giant of the forest has been felled and lies useless, for the trunks are rarely used for timber, the expense of transporting them to the mills from the high mountain slopes being in most cases prohibitive.

But great as is the work of the lumberman in this forest destruction, his part has in the past been small when compared with that of the forest fire and that of the farmer in clearing land for agricultural purposes. Forest fires have been one of the great curses in the southern Appalachians as truly as elsewhere in the country. They were common in the days of Indian occupation. Thus, they have preceded the lumberman, but they have also accompanied him and followed in his wake. Their work has been rendered far more destructive because the lumberman has left his brush scattered among the remaining growth in such a way that in the burning it has fed the fire.

In some regions these fires have destroyed the forests entirely. Especially has this been the case where the soil has been thin and composed largely of humus. The fire has destroyed this humus and the remaining soil has soon washed away, leaving the trees on the bare surface of rock, to dry out and die. Even under more favorable conditions these fires have de-

stroyed the undergrowth, and the larger trees have been burned near their roots in such a way as to cause their destruction. The repeated fires have frequently exterminated the grasses and other forage plants, so that instead of improving the pasturage, which has often been the object in starting the forest fire, the result has been, in the course of years, its almost total destruction.

This burning of the humus and the undergrowth in the forests always seriously affects the flow of the streams. No one who has ever been in a forest during a heavy rain-storm can fail to realize this fact. In the virgin forests the raindrops are caught by the underbrush and pass downward through the humus into the less porous soil and the rock fissures beneath, to reappear weeks and months later in the form of numberless springs. But where this underbrush and humus have been burned away, one can not fail to see that during a heavy rain storm much less of the water soaks directly into the soil, and the remainder flows down the surface with a velocity varying with the slope, sometimes washing the soil into small furrows and gullies. Hence, the burning of this humus decreases the storage of water in the soil and causes the more rapid accumulation of this water in the brooks, and results in floods in the larger streams below.

Following in the wake of the forest fire in this connection is the farmer, who is continually clearing the mountain slopes for agricultural purposes. Instead of trying to improve his soil in the valley and on the adjacent slopes he has for years followed the policy of clearing additional patches on the mountain side as rapidly as others are worn out and abandoned. Each one of these hillside fields must be abandoned in from three to five years, as their productiveness is short-lived. After the trees have been girdled and the underbrush has been destroyed, such a field may be planted in corn for one or two years, then in

grain for a year, and one or two years in grass. Then it may be pastured for a year or two until with increased barrenness the grass gives place to weed and the weeds to gullies.

Within two or three years after these mountain-side fields have been cleared the soil loses its color, changing from dark gray or black to red, as the organic matter disappears. Meanwhile it is losing more and more its porous nature, and hence its capacity for absorbing water; and the rains being unable to soak into it wash it away.

Thus, the lumberman, the forest fire, and the farmer co-operate in the work of forest destruction and the consequent disturbance of the regularity of the flow of the streams. This increases the floods which destroy the valley lands below, and as the irregularity of their flow increases the streams lose their value for water powers during the dry season, and during the season of rain the floods wash away the farming lands in the valleys and carry destruction along their courses across the lowlands. As the rains wash away the cleared fields on the mountain slopes and the farming lands in the valleys, these soils on their way toward the sea incidentally silt up the river channels and the harbors. Hence, it is strictly true that in destroying forests these agencies are removing the soils, ruining the rivers, and destroying agricultural and manufacturing interests, and incidentally seriously affecting important navigation facilities.

In New England and many of the Northern States the numerous lakes and glacial deposits of sand and gravel, spread out over the hills and valleys, serve as storehouses for the water and help materially to preserve uniformity in the flow of the streams. In this respect they co-operate largely with the forest cover in that region; and indeed they would accomplish much in that direction were the forest cover entirely removed. But in the southern Appalachian region there are no lakes and no glacial gravels and

sands; the forest and the soil are the factors upon which the solution of the problem of water storage depends. And that the problem resolved itself largely into one of forest cover, with its undergrowth and humus, is seen by the fact that in the streams of the Piedmont Plain of the South Atlantic States the irregularity in flow, as observed for a number of years, has been almost directly proportional to the extent of forest clearings. Observations and measurements of the southern Appalachian Mountain streams made during the last few years show that the same is true in that region. Hence, here the water problem is a forest problem.

STREAM FLOW IN THE REGION AND ITS MEASUREMENT.

The region is well watered, and from it several of the largest rivers of the country receive their supply. The chief rivers in the States of Virginia, North Carolina, South Carolina, Georgia, Alabama, Tennessee, and West Virginia rise in these mountains. One of the principal tributaries of the Ohio and one of the largest feeders of the Mississippi head here also. So that this region may justly be considered one of the important watersheds of the United States. The Yadkin, Catawba, Broad, Saluda, and Chattahoochee flow into the Atlantic. The Chattahoochee and the Coosa flow into the Gulf. New River flows to the north and enters the Kanawha, whose waters finally reach the Mississippi through the Ohio, while the Tennessee, with its large tributaries, the Holston, the Nolichucky, and the French Broad, flow to the west through the State of Tennessee, finally entering the Mississippi. The Cheoah, the Nantahala, the Oconalufy, and the Tuckasegee, all large streams from 50 to 100 yards wide, join their waters to the Tennessee and flow in a narrow and rocky gorge through the Great Smoky Mountains, while the Hiwassee unites with that river in the State of Tennessee beyond the mountains.



Lower Callasaja Falls, Macon County, North Carolina.
One of the sources of the Little Tennessee River.

An examination of the watersheds and a general investigation of the streams in this mountain region were made by the United States Geological Survey during the summer of 1900.

During the hydrographic investigation of this region, extending through 1900 and 1901, measurements of flow were made on the larger streams and more than one thousand of their upper tributaries, and 54 gauging stations were established. At each station a gauge was permanently placed, upon which the height of the water surface was read and recorded daily by a local observer, and to which were referred the current-meter measurements, which were made about every sixty days, or oftener, as circumstances demanded or permitted. From these data a curve was plotted, according to the method usually followed by the Survey. From this curve, the mean of the daily gauge readings being known, the approximate daily discharge has been calculated. The great difficulty encountered at these stations was to obtain measurements at the time of high water, for after a rain the rivers rise rapidly and fall as quickly. Hence, unless the observer is on hand at the time, the high water passes before he can reach the point of measurement.

VALUE OF THESE MOUNTAIN STREAMS FOR WATER-POWER PURPOSES.

The greater part of this region is occupied by gneiss rocks, having for the most part a characteristic northeast-to-southwest strike, the irregular rock layers dipping beneath the surface at varying but generally steep angles. The southern half of the region has along its western border an irregular belt of bedded slates, limestones, quartzites, and conglomerates. These rocks, which make up the great bulk of the surface, have a general northeasterly strike, and a steep but varying dip; while near the eastern border there is another, but narrow and more irregular, belt of rock of somewhat similar character, which fol-

lows approximately the general position of the Blue Ridge, and dips steeply southeastward.

As stated above, the important streams rising in Virginia, the Carolinas, and Georgia have their origin on the slopes of the Blue Ridge. Those rising on the eastern slope, such as the James, Roanoke, Yadkin, Catawba, Broad, Savannah, and Chattahoochee, flow generally toward the southeast, their head streams plunging down the mountain slopes many hundreds of feet in short distances and soon reaching the gentle slope of the Piedmont Plain. The streams rising on the western slopes of the Blue Ridge—the Watauga, Nolichucky, French Broad, Pigeon, Little Tennessee, Tuckasegee, and Hiwassee Rivers—flow in the general characteristic northwesterly direction across the upturned ridges of the gneiss and more recent bedded rocks, with frequent falls, into the great valley of East Tennessee. The Holston River, which flows along this valley from its upper end to its junction with the Tennessee system, forms an exception to the general direction of flow in this region, for its course lies toward the southwest; and the Coosa River, of Alabama, which has its headwaters on the southeastern slopes of the Blue Ridge, takes a similar direction. The New River, also, which rises in the cross ranges connecting the Unakas and the Blue Ridge, flows toward the northwest into the Ohio. The elevation of the country is so great and the descent of the stream is so rapid that the general course of the principal rivers has been but little modified by the geologic structure of the region, though they lie directly across the strike of the rocks. The resulting conditions produce occasional falls and cascades in the streams; but the larger part of the courses of these streams consists of a succession of rapids, furnishing ample opportunities for water power development by the building of dams at intervals across the deep narrow gorges. A number of the small tributary streams in North Carolina and in Vir-

ginia flow in either a northeast or southwest direction along the strike of the rocks, and at places give rise to conditions favorable to water-power development. This is the case for the most part where a change in the direction of flow causes a change in the character of the rock in the stream bed.

In northern Georgia different conditions seem prevalent; the general

in each case is about 300 feet within a short distance. These are found on rather small streams, but illustrate the difference in the prevalent conditions.

As before stated, this part of northern Georgia embraces the headwaters of three great drainage systems—the Coosa, the Chattahoochee, and the Savannah. At various points along their courses all of these streams possess



A Spring on Southern Slope of Mount Mitchell.

These perennial springs are fed by water stored in the forest-covered slopes of these mountains. They maintain the regular flow of the many mountain streams of this region.

course of the stream is southeast or southwest, and many shoals and cascades are to be found. Some of the cascades are of great height, and large water powers could be easily and cheaply developed. Notable among these are Tallulah Falls, where the descent is 335 feet in about 4,000; Duke's Creek Falls, Minnehaha Falls, and Annie Ruby Falls, where the descent

magnificent water powers which present conditions favorable to development, and which at some future time will be made to supply the varied and growing industries of the nearby region with the power necessary for their continuance and growth. Any impairment of these powers by diminution of the low-water flow of these streams will most assuredly work

great injury in future years to the industrial welfare of the region.

The states through which flow the streams rising in the region of the proposed Appalachian forest reserve have for many years past been devoted mainly to agricultural pursuits; but within recent years a great awakening has come, and a tendency to manufacture the raw material at home has become manifest. Already the results are to be seen in the increased prosperity of the region, resulting from the development of diversified industries.

This tendency is growing with great rapidity, and while its beneficial effects will be felt most in the section where it has appeared, it cannot fail to have a considerable influence on the prosperity of the entire country, for prosperity comes to those who produce sooner than to those who consume—to the seller who can supply the commercial needs of the world, rather than those who feel the want.

Water power is universally recognized as the cheapest power to be secured for any species of manufacture; for when once the constructional development is at an end the attendant expenses become very small, since, through the operation of the laws of nature, the water flows without cost by day and night, while every ton of coal that passes in at the furnace door represents a certain expenditure, and in plants requiring great power this fuel cost may come to represent a large proportion of the cost of manufacture.

In the past the chief advantage of steam power over water power was the mobility of the former, for steam could be generated wherever fuel could be obtained and mills could be built where the transportation facilities were such as to insure the quick disposal of the finished product. By reason of the great improvements in electrical transmission of power, steam has lost its advantage, for water power can now be brought to a mill for distances of many miles more cheaply than power can be obtained from coal at most points. The water powers, therefore,

in the not far distant future may become as valuable as coal mines, and as the local coal supply becomes more costly by reason of deeper mining the water powers will increase in value.

This wealth should not be wantonly wasted. Its present value can be conserved and its future value increased by the preservation of the forests about the headwaters of the streams; and this preservation would seem desirable therefore, if for no other reason than this, entirely apart from the wealth-producing capabilities of the forests themselves.

It is impossible at this time to give an accurate statement of the total power available on all the streams rising in and flowing from this area, for the reason that the power on any stream cannot be determined accurately without a survey of the entire course of the stream with this object in view, and any discussion of this, based on the total fall from source to mouth and the average quantity of water carried by the stream, would be worse than misleading, for the mere fact that there is on any stream a certain fall within a certain distance, over which flows a certain amount of water, does not mean that this locality constitutes an available water power. Theoretically the power is there, but practically it is non-existent unless it can be developed and brought to use for a sum which is not prohibitive. In other words, the availability of a water power depends entirely on the economic situation at the point considered, and every location must be viewed by itself in such determination.

It is, however, certain that on all of these streams large amounts of power can be easily and cheaply developed when the demand for it is sufficient, for the average fall in the streams is great, and is noticeably high at great numbers of point, while the low-water flow is fairly large on account of the large annual rainfall and the storage effect of the great forests. Furthermore, at many points the conditions favorable for easy and cheap develop-

ment are present; and on some of the streams surveys have been made which render approximate estimates easy.

In regard to the power actually utilized conditions are more favorable, since such information can be readily obtained by letter and inquiry from the owners and users thereof, and such has been obtained and is presented

8,700 horse power, of which amount 2,500 is used by a single plant recently built.

On the James River, the amount of available power is estimated as about 50,000, of which not more than 17,000 is actually in use. On the Yadkin River the available horse power is estimated at 60,000, the amount actually



Newly Cleared Mountain Field Planted in Corn, Rapidly Washing Away.
These steep hills will be ruined and abandoned in less than a decade.

here below. The aggregate amount is very small, for the reasons that the entire region is largely agricultural in its pursuits and that manufacturing is only beginning.

On the New (Kanawha) River and its tributaries, where the available horse power amounts to 60,000, the amount actually reported as used is

used being about 2,500. The available power of the Catawba River is estimated at 57,000 horse power, the amount in use being 4,000 horse power. On Broad and Saluda rivers, the available power is estimated at 43,000 horse power, the amount actually used being about 25,000 horse power. The available power on the Savannah Riv-

er is estimated to be about 77,000 horse power, the amount used being about 1,000 horse power. Near the fall line the city of Augusta has developed about 11,000 horsepower.

On the Chattahoochee River the available power is estimated by Mr. B. M. Hall to be 115,000 horse power, the amount utilized being only about 10,000, while the available power on the Coosa River is about 140,000 horse power, the amount in use being approximately 13,000.

On the Tennessee River, in Alabama, there is available 100,000 horse power; while on the tributaries of the Tennessee, in North Carolina and Tennessee, large amounts of power are available, as shown in the following paragraphs:

On the Hiwassee and its tributaries the available power is estimated to be 75,000 horse power, though the amount used is very small, the only users of power in the basin being some small plants.

On the Little Tennessee system, including the Little Tennessee, Cheoah, Tuckasegee, Nantahala, Oconalufy, Tellico, Ellijay, and Little Pigeon rivers, the available power is 100,000, while the amount utilized is only 1,700.

On the French Broad River and tributaries, rising in the southern Appalachian Mountains, the aggregate horse power available is 50,000, while that used is about 3,500, though more than this will come into use in the near future when some developments which are now under way are completed. Others in this basin are projected.

In the Nolichucky Basin about 700 horse power is in use, and 35,000 available.

On the Watauga the amount of power available is 20,000, while only a few small powers have been developed, aggregating 450 horse power. In the Holston Basin 4,700 horse power has been utilized, and 40,000 remain undeveloped.

It would be entirely safe to estimate the available but undeveloped water power on the streams rising among the southern Appalachian Mountains as equivalent to not less than 1,067,000 horse power, and the developed power is 117,750. It would also be entirely correct to state that the future value of these water powers, as, indeed, the future value of almost everything of value about these mountains, depends largely upon the future preservation of the forests.

A FOREST RESERVE IN THE WHITE MOUNTAINS

Reasons Why the East as Well as the
West Should have Forest Reservations

BY

HON. FRANKLIN W. ROLLINS

Former Governor of New Hampshire; President of Society for the Protection of New Hampshire Forests.

RESERVATION of forest lands in the West under four presidents—Cleveland, Harrison, McKinley, and Roosevelt—has met wide approval. Nearly 100,000,000 acres are now set apart. These are government lands

reserved by proclamation, and all are located west of the Mississippi River, except that in Minnesota at the headwaters of that river. This reservation was established by a recent act of Congress, and purchased in part from the

Chippewa Indians, taking a portion of the land and timber formerly granted to them. With the sharp advance in prices of timber, showing plainly the partial exhaustion of best grades in the East, the question arises, shall the government establish forest reservations in the East also, where the land and timber must be purchased, and where both are held at relatively high figures. The following are among the reasons why forest reservations should

the average higher prices than the original crop cut within the memory of men now living. In the disappearance of the first crop of pine timber New England suffered severely. Woodworking factories ceased to locate here; the mills disappeared; population in large sections decreased; farms were abandoned. Even now the sash and door factories that remain import much of their best material from Michigan, and the profits are not such as to encourage



On the North Slope of the Presidential Range, White Mountains.

be established in the East as well as in the West:

1. *Proximity to market.* Wood is one of the great staple products of the country upon which our wellbeing rests in large measure. The advance during the last five years in the prices of all timber products has caused us to open our eyes to an entirely new situation. Even the second or sapling growth of white pine now being harvested in New Hampshire is yielding on

sons to follow the business of their fathers. Is it not plain economy to use non-agricultural land near the centers of population for timber crops? Because of the time element involved in growing trees, private ownership can never be relied upon to do it satisfactorily on a large scale. The states of New York and Pennsylvania have recognized this and have established large state reserves, secured by purchase. Their commendable action,

however, is not commensurate with the situation, nor can state action alone be relied on to meet the need. All of the New England states are interested in a reservation at the other end of the Appalachian chain, but no state is capable of securing the lands necessary for the benefit of its neighbors, nor can any state grant money for use in another. The benefits of a reservation extend beyond the borders of any one state and are a proper subject for federal action.

are not used for irrigation purposes, they are used to a much greater degree for manufacturing purposes, and their protection both from floods and droughts is equally a matter of vital national import. It has been pointed out by the president of the Amoskeag Manufacturing Company, located at Manchester, N. H., that one flood a few years ago cost that company \$100,000. The eastern rivers are used not only for manufacturing, but their navigation has become a vast business.



A "gravity railroad" in the White Mountains. The trucks are pulled up by horses and the logs run down by gravitation—sometimes you reach the bottom safely.

2. *Protection of water flow.* One of the most important results from the establishment of western reservations is that they make it possible to carry out the provisions of the irrigation laws passed by Congress. Probably no more important action has been taken by the federal legislature in recent years than those establishing the forest reservations and the irrigation projects. While the rivers of the East

They are also for many large cities a source of drinking water. It is folly not to realize the need for their protection in the mountains; and as a forest reservation requires time for growth and development, the federal government cannot begin too soon to protect its eastern rivers as it has already protected its western rivers.

3. *A reservation would steady the industries dependent upon forest*

growth. Hitherto the timber business in the United States has been more or less a shifting and ephemeral one. Towns have sprung up like mushrooms, to disappear with the vanishing forest. Whole towns in New England have dwindled and even died out since the cutting of the original white pine, and others now dependent on the spruce forests must follow the same course in fifteen or twenty years, unless something is done to recuperate

that New Hampshire imported last year from Canada 37 per cent of all the spruce logs used in the manufacture of paper pulp.

4. *The movement is widely approved and urged upon Congress.* The propositions for national forest reservations in the White Mountains and in the southern Appalachian Mountains have met thus far no serious opposition. They are universally commended. The press of the country has



Making a road for cutting at the commercial timber line in the White Mountains, 3,500 feet high—expensive, and not much profit to the operator, but most destructive to the forest.

the timber industries, to renew the sources of supply, and thus maintain the population upon the soil. Contrast our situation with the happy and prosperous life in the Black Forest region in Germany, where, under government regulation of felling and planting, no danger from exhaustion arises. We may well fear German competition in manufacture until we have placed our supplies of raw material upon an equally sound basis. It is significant

given hearty support, and trade associations in all the lines affected, including the American Paper and Pulp Association, the National Wholesale Lumber Dealers' Association, the National Board of Trade, the American Forest Congress, and many local bodies have urged these reservations upon Congress. Both measures have been agitated now for some time. It seems as if the time for congressional action has arrived. Let the sons and

daughters of New England who are spread so widely throughout the West and the South unite in urging their respective congressmen to support these measures, and let the great

throng of men and women who find rest and recreation in the mountain regions of New England join in the agitation for a national forest reservation in the White Mountains.



The Franconia Notch in the White Mountains where some of the most destructive clean cutting is done on the high slopes.

THE SIZE OF IRRIGATED FARMS

A Matter of Great Importance in Working Out National Reclamation Projects.

One of the most important problems arising in the administration of the Reclamation Act is the determination of the size of farm units on the projects that are under construction by the government. The law provides that the land to be irrigated shall be subject to entry in tracts of not less than 40 nor more than 160 acres. As the intention of the law is to provide a homestead sufficient to support a family, it is necessary to carefully examine the conditions that will confront the settlers upon these areas.

While the size of a farm unit will depend to a certain degree upon local conditions, there are some general considerations that are of great importance and must be taken into account. Not only must the character of the soil be a criterion, but weight must be given to the character of the settler and his opportunities for making a livelihood. It is not enough to say that the irrigated farms should be limited to the size of those in particular areas where agriculture is highly developed and where the farmers have

acquired an unusual amount of skill and experience. The determination of the farm unit must depend on the results to be obtained by the average farmer. The unit should be of such size that wasteful or slothful methods of agriculture will not be encouraged, but account should be taken of the capabilities of the men who are going to settle upon these lands. In short, the size of the unit should result in the most advantageous development of the agricultural and industrial resources of the country.

The size of an irrigated farm depends upon the crop which may be grown upon it, which in turn are governed by the climate, soil, water supply, transportation facilities, the character of the surrounding country, and, most important of all, upon the class of farmers on the land. Forty acres of land properly handled are probably sufficient for the support of a family in any part of the West, provided the head of the family possesses the requisite knowledge, skill, and industry to make the land produce its best crops every year. The average American farmer, however, is apt to lack one of these three requisites, particularly when entering a new country. He must spend several years learning how to farm, and meanwhile he is obliged to make a living from a kind of agriculture that is not so profitable as that he will pursue five years later. Furthermore, to make 40 acres support a family, the land must have been under cultivation several years and in the best possible tilth.

Most of the reclamation projects are at considerable distance from centers of population and established markets. In such cases the farmer will find difficulty in opening a new market for his products, and it is likely that during the first years of his residence he will receive minimum prices for his crops. As practically all the irrigation works will be completed by the time he commences to harvest his crops, there will be no sale for hay and grain to contractors.

Most of the projects that are at a distance from the centers of population are in the midst of large stock ranges. There is a ready sale for hay and feed, which during the first years of settlement will probably be raised easier than any other crop. The tendency will be to plant alfalfa. If the settler is a good farmer, he may in the first three years average six tons per acre per year. If he has 35 acres in alfalfa he will produce 210 tons per year, and at \$4 per ton will realize \$840. The cost of putting up this hay will certainly be 50 cents per ton, or \$105, and the payment of his water right will be \$120. This will leave \$615 to support his family for a year, which may be considered ample.

The above results will be achieved under the very best conditions. If the settler is not an experienced irrigator, but is only an average man, his return will not be near so great. The first year he may not get all of the 35 acres seeded, or he may lose a part of his stand. For the first three years he may average only $3\frac{1}{2}$ tons on his 35 acres, which gives him a yield of $122\frac{1}{2}$ tons. From this he may realize \$490; he must pay \$62 for harvesting and \$120 for water right, and will have left \$308 to support his family. Had this man 80 acres of land, he would have been able to put in a larger acreage and with due diligence the income on this second 40 acres would have equalled that on his first 40 acres, giving him at the end of the year \$600 for the support of his family.

The feeding of hay to stock generally is more profitable than selling it, and this method has the advantage of returning to the land valuable plant food. For this reason many farmers, when selling hay, contract to feed it on their farms at the going price. The farmer who has only 40 acres loses this opportunity, as he has neither the quantity of hay nor the room to make such an undertaking successful.

Many intelligent farmers claim that a man cannot profitably raise stock on from 32 to 35 acres of available land

on a 40-acre farm, and this is rarely done where outside range or other pasture is not available. At present large cattle and sheep companies control most of the range. Thus, with his hay crop as his principal asset and the necessity for prompt sale at the end of the crop year, the forty-acre farmer is very much at the mercy of the stockman of large interests. This condition is very likely to confront the farmer during his first four or five years when he is limited to one crop and when his struggle is the hardest and ready money is most needed.

The agriculture of such projects will some day be entirely changed, and in all probability sugar beet and fruit growing may become important, and make 40 acres or smaller farms desirable. Until that time comes, conditions as they exist must be dealt with, as it is not possible to change in a short time the kind of agriculture being carried on in any district. Fruit growing cannot be made successful in a valley where the stock business is predominant, nor can dairying be carried on in a region where fruit growing has been the principal industry for a long time. These changes are, of course, possible, and will in many cases take place; but the process is a slow one.

The critical period in the history of

each irrigation scheme comes in the early years of its operation. Failures by farmers are then common, and there is no ground for believing that farmers taking land under government projects will be abler than those who have heretofore inhabited the West. During the first years methods of agriculture will be crude, low-priced products will be produced, and in consequence a larger area of land will be needed for the support of a family than later in the history of the region. These first few years are going to be the critical ones. If the farm units are made too small and the settlers are unable to pay the charges for the water and the lands, not only will future work be hampered because the money has not been returned to the Reclamation Fund, but the main purpose of the law, the settlement of the West, will be prevented. Instead of prosperous farms and a contented settlement, there will be seen dismal abandoned homesteads eloquent of failure and despair. In a district where fruit growing will be the principal crop the unit may safely be limited to 40 acres, but under the projects that are removed from established markets and from centers of population the best policy will probably be to make the farm unit 80 acres.

FORESTRY IN NEW JERSEY

BY

DR. JOHN GIFFORD

Vice President of the American Forestry Association for New Jersey.

PROGRESS in forestry in the State of New Jersey has been slow but gradual. Although the subject has been agitated in various ways for many years, nothing very tangible was ever accomplished. This tardiness was due to various causes. First, in spite of the activities in the nearby States of New York and Pennsylvania the New Jersey legislatures, although not hos-

tile, were merely lukewarm on the subject, and although they passed bills from time to time they never appropriated sufficient money for their enforcement. Although the State of New Jersey has had, and still has barrels of money in its treasury, much of which is secured from corporations and none of which is wrung from the tillers of the soil, it has been loathe

to part with it for such purposes. Second, all the lands in the state to which no parties had a valid claim became the property of the descendants of the Lords Proprietors, a relic of the days when New Jersey was a British province. There were, in other words, no state or federal lands to reserve and care for. Then again, legislation follows rather than precedes public opinion. It usually lags far behind, and often comes too late to do much good. But all the efforts of the past were taking root to finally spring forth into something worthy of note. The recent revival of interest in the subject has its root in the election of Governor Stokes, a man from the pines, who has been interested in the subject of forestry for some time.

An elaborate bill was passed, money was appropriated, not much, but enough to start with, an able commission appointed, and the purchase of land begun.

It the purpose of this article to record some of the efforts which have led up to this recent revival of interest, to describe what the commission has accomplished in the short period of its existence, and to indicate as far as the writer knows, its policy for the future.

Among the various factors which have been potent in moulding public opinion on the subject, the publications of the New Jersey Geological Survey are foremost. In fact, this institution has fathered the subject from the start. From the year 1856, almost every report contains an important contribution on this subject. Much credit is due Professor Cook, of the Geological Survey, who worked hard for the preservation of the forests at a time when there were few sufficiently interested or concerned to uphold and help him.

For many years following Professor J. C. Smock, who succeeded Professor Cook as State Geologist, had the subject constantly in mind, and at heart. He deprecated the fact that fires were converting pine timberlands into scrub-

oak barrens, and employed experts to investigate and report on the conditions of the forests of the state. The urgent need of forest protection on the watersheds, especially in regions suitable for water supply to cities, was vigorously championed by Professor Smock at the meetings of the board of the Geological Survey. This board consisted of a set of broad-minded, eminent men. It was untrammelled by political bias and it was no doubt while he was a member of this board that Governor Stokes developed such a keen interest in the subject. It is, therefore, highly fitting that the Governor, Professor Smock, and Mr. Kummel, the present State Geologist, should be members of this commission.

At one time in New Jersey there existed a State Forestry Association. In the early days, Dr. Joseph Rothrock would come over from Pennsylvania, Dr. Fernow would come up from Washington, and Colonel Fox would come down from Albany, and these, together with a few officials at the State House, a few foresters, a few enthusiasts, and a few nondescripts would constitute a meeting. Almost everybody present was already converted, but the discussions did some good and the newspapers always reported a full and highly successful meeting. This started in the southern part of the state, under the name of the South Jersey Woodmen's Association. It had at one time a large membership and although extinct, it played its part. It helped to arouse interest in the subject by the distribution of literature and by lectures here and there. Through its invitation the American Forestry Association held a peripatetic meeting in New Jersey. A full itinerary was arranged, but the secretary of the American Forestry Association, or somebody, neglected to send out the announcements in time, so that when the American Forestry Association arrived in New Jersey, it consisted of three officers of the Association and their wives. Nevertheless active meetings were held and the press notices

Many of these waste places of Europe were improved by monks who, with religious zeal, were eager to do penance by working in the most inhospitable regions.

In the northern part of the state there is some land which the commission will avoid. It consists of bare rock with here and there patches of thin soil.

In buying land bearing a good young growth of desirable species, the cost of planting, which is often more than the land is worth, is avoided. It will soon also yield materials from improvement cuttings which can be sold.

The question often arises—does it pay to fight fire in regions where there is nothing but scurb-oaks and a few scattering pitch pines? If no other and better timber is endangered, and if the owner is a Philadelphia land-speculator, who can blame the poor native who depends on huckleberries for complacently letting it run?

In New Jersey, as elsewhere, the success of these reservations will depend mainly on two points. The first is the personal element which means success or failure to any enterprise. Just as some men will make a farm pay where others have failed, so will

some men make reservations pay where others will fail. There are other factors to be counted but by far the most important is the man behind it.

The second factor is perpetuity without constant change. Will the legislature and the powers that be let the good work go on without meddling and change? If there is any one thing essential to forestry it is a well conceived plan covering not ten years, or twenty-five, but many years. The change of men is not so serious if they are all able and honest, but the plan of procedure must be lasting. In the change of men, however, one dishonest or incapable man may undo the work of years in a very short time. The personnel of the present commission, and the plan they are working on, are all right. Let us hope that nothing may interfere to bring it to an untimely end, but it will require patience and skill to guide it in the straight and proper course in the years to come. While Governor Stokes is in power, the good work will go on in the proper way, but there will be other governors, and governors are not always up-to-date on the subject of forestry or immune to ulterior influences.

GOVERNMENT CONTRACTS

Great Need of Care on Part of Contractors Who Undertake Building Huge Irrigation Works.

There seems to be a peculiar fascination about a government contract and a widespread belief that a person who secures a contract from the government is certain of large profits and easy work. As a result, there are many inexperienced persons who are continually seeking contracts and who, out of their ignorance, frequently succeed in getting into very embarrassing situations. There is nothing more irritating than the effort of inexperienced persons to try to get a contract, and if by chance it is awarded to them, they seek not to execute work as required,

but to shirk the obligation incurred.

The Reclamation Service, having a new class of work, has been put to much trouble and expense by inexperienced or speculative individuals who have, in some cases, made bids ridiculously low and have insisted on having the contract awarded to them in spite of the warning of skilled men that they would incur large losses in carrying out the work specified. These people do not and will not understand that the contracts they enter into are very carefully guarded, and that no discretion or leniency is possible after the

contract is signed. They seem to forget that an employee of the government cannot modify the contract, no matter how onerous it may be, and that their property and that of their friends who have gone on their bond must be taken by the government in default of the work.

The warnings given these people frequently have been treated with contempt, under the belief that the engineers had some friend they wished to favor. In several instances the lowest bidders have been frequently told that they could not do the work for anything like the amount offered, and that, if they entered into a contract, they

to give to the government all of his property, the results of years of hard toil, if his friends could be relieved from liability. But unfortunately there is no way by which relief can come to him, and he must day by day see his property eaten up, the bonds being so complete and the terms so exacting that he cannot escape.

In other cases men seek to slight their work or to induce inspectors to pass it without full compliance with the terms. There thus results a continuous and exasperating warfare, the man losing money and the government agents insisting that he perform his work according to specifications.



Completed Diverting Dam and Spillway, Carson River, Nevada.

must fulfill it to the letter and spirit. They have laughingly retorted that they know how to do business; have executed bonds, and then have awakened to the dismal fact that they must carry out the law and obligations and cannot secure relief. One poor fellow who should have known better secured, after great exertion, a contract for hauling supplies over a high mountain range. He put all his possessions and that of his friends into an excellent equipment, but discovered too late that the price he had bid was far below what it would cost to feed his horses and maintain his equipment. He has begged time and again to be allowed

There is no desire on the part of any one connected with the government to let a contract at less than a fair rate, with reasonable profit. It is far better for all concerned that the contractor make fair wages for his men and a small return upon his capital invested. The engineers of the Reclamation Service, having spent the best part of their lives in such work, know as a rule very nearly what it will cost, and they view with apprehension the incursion into the contracting field of men who have never had experience and who are enamored with the idea of getting a job of this kind.

A VOICE FROM THE DESERT

[Lines written on the forest destruction in the White Mountains of New Hampshire, by a resident of the arid southwest after spending a summer in the Granite State.]

Wandering tribes now roam
The hills of Lebanon,
Knowing not house nor home;
Gone the great cedars, gone
That temple built of them
Once in Jerusalem!

* * * * *

Once our forefathers heard,
Under their sacred oak,
Some strangely muttered word,
Whispered by tongues that spoke
Forth from the Druid tree,
Darkly, of things to be.

Though to our senseless ears
Forest and wood are dumb,
Now, in the lapse of years,
Our brothers' sons who come
Out of a treeless land
Hearken! and understand.

Men of the West, come forth!
Leaving your desert plains;
Tell to the East and North
Secrets the long-sought rains
Bear to your land of drouth
There in the burning South!

Men of the East, beware!
Listen, and understand:
Who strips your forest bare,
Ruins the whole fair land;
And by most ecet stealth
Despoils your common wealth.

Seeking new gods, you list
These prophets of a day,
Who, for their daily grist,
Grind the wild woods away,
And with unholy haste
Lay the wide forest waste.

No longer give to greed
Your sons' best heritage!
Lo, he who runs may read
The woodland's open page;
And, in that book, the fate
And future of our State.

ALEXANDER BLAIR THAW.

THE RECLAMATION SERVICE

News Notes of the Various National Irrigation Projects Now in Course of Development.

LAND WITHDRAWALS

Under direction of the Secretary of the Interior, the Commissioner of the General Land Office has withdrawn from settlement, entry, or other form of disposal under the public land laws, except the homestead law, the public lands within the following described areas, in connection with the Cherry Creek project, North Dakota:

Fifth principal meridian.

T. 146 N., Rs. 102, 103 W.
T. 147 N., Rs. 100, 101, 102, 103 W.
T. 148 N., Rs. 99, 100, 101, 102 W.
T. 149 N., Rs. 97, 98, 99, 100, 101 W.

T. 150 N., Rs. 97, 98, 99, 100 W.
T. 151 N., Rs. 97, 98, 99 W.
T. 152 N., Rs. 97, S. $\frac{1}{2}$, 98 W.

The Secretary of the Interior has also directed the temporary withdrawal from any form of disposition whatever, the following described lands, in connection with the Yakima project, Washington:

Williamette meridian.

T. 12 N., R. 17 E., Secs. 1 to 6 inclusive, 8, 9.

T. 13 N., R. 16 E., Secs. 25, 36.

T. 13 N., R. 17 E., Secs. 1 to 4 inclusive, 10 to 15 inclusive, and 19 to 36.

T. 13 N., R. 18 E., Secs. 6 to 9, 15 to 22 inclusive, 31, 32.

T. 14 N., R. 16 E., Secs. 1, 12, 13, 24, 25, 35, 36.

T. 14 N., R. 17 E., Secs. 6 to 9, 15 to 22, 25, to 36 inclusive.

The Commissioner of the General Land Office has also temporarily withdrawn from any form of disposal under the public land laws, except the homestead law, tracts of land in connection with the Williston project, North Dakota, and the Buford-Trenton project, North Dakota, as follows:

Williston project, 5th principal meridian:

T. 156 N., R. W. $\frac{1}{2}$, 101 W.

T. 157 N., Rs. 99, E. $\frac{1}{2}$, 101 W.

T. 158 N., Rs. 99, 100, N. $\frac{1}{2}$ 100, S. E. $\frac{1}{4}$ 101 W.

T. 159 N., Rs. 5 $\frac{1}{2}$ 99, S. $\frac{1}{2}$ 100, S. E. $\frac{1}{4}$ 101 W.

Buford-Trenton project, 5th principal meridian:

T. 150 N., Rs. 101, 102, E. $\frac{1}{2}$ 103 W.

T. 151 N., Rs. 101, 102, E. $\frac{1}{2}$ 103, W.

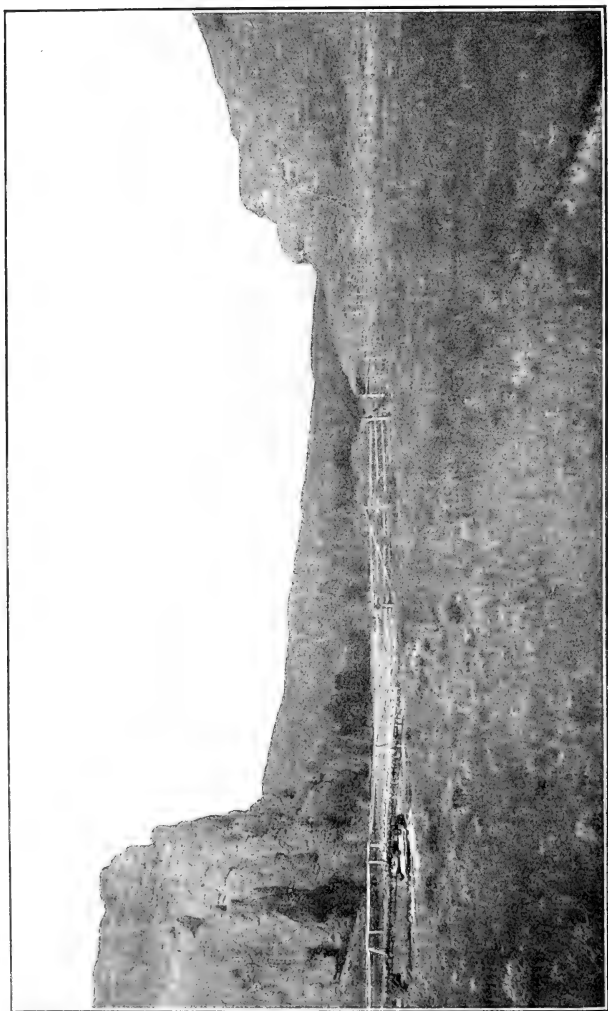
T. 152 N., Rs. S. $\frac{1}{2}$ 101, S. E. $\frac{1}{4}$ 102 W.

The last two areas have been previously withdrawn under the first form of withdrawal, but as the lands are no longer necessary for construction work, and are deemed susceptible of irrigation under these projects, they have been withdrawn under the second form.

HUNTLEY PROJECT CONTRACTS

The Secretary of the Interior has again awarded contracts for the construction of Divisions 1, 2, and 3, main canal, Huntley project, Montana, as follows: Division 1, consisting of nearly two miles of canal, Cotton Bros. & Co., Oakland, California; Division 2, consisting of nearly eight miles, W. D. Lovell, of Minneapolis, Minn.; and Division 3, consisting of about thirteen miles of main canal and six miles of lateral, to Callahan Bros., Phelan & Shirley, of Omaha, Neb. The amount of the three bids was \$118,560, \$43,245, and \$53,210, respectively.

This project contemplates the reclamation of about 35,000 acres of land along the south side of the Yellowstone River, such lands having been



Windy Gap Dam Site, Colorado.

ceded to the government by the Crow Indians by an act of Congress approved April 27, 1904. Under this act it is provided that the work shall be constructed and all the lands disposed of within five years from its passage. Inasmuch as the necessary diversion works in the Yellowstone must be constructed during low water, and as a considerable portion of the first division will be excavated below the low water level of the river, this contract is an important step toward fulfilling the conditions of the agreement within the required period. According to the estimates the work will cost about \$26 per acre, to which must be added the sum of \$4 per acre for the land, to be paid the Indians.

The President of the United States is authorized to issue a proclamation giving notice to the public that the lands will be thrown open to entry, and such notice will be issued at the proper time. It is hoped that the irrigation system will be in condition to furnish water in 1907.

SERVICE NEWS NOTES

The Clark's Fork Water Users' Association, through Senator Clark, has forwarded a request to the Director of the Geological Survey for a government survey for irrigating canals to cover land adjacent to the Clark's Fork River in Carbon county, Montana.

A preliminary survey was made by the State Engineer, and it is believed by him that a canal 35 miles long, to cover 44,000 acres of tillable land on the west side of the river, and a canal 10 miles long on the east side of the river to cover 200,000 acres, are feasible.

A party under Mr. James A. French is now in the field making a reconnaissance survey.

Two projects are already under construction in the state of Montana, one near Glendive, on the Lower Yellowstone, and one near Billings, on the Crow Indian Reservation. It is hoped also to put either the Sun River

or Milk River project under construction as early as practicable.

The Secretary of the Interior is advertising for bids for the construction of about 33 miles of main canal and 74 miles of branches and laterals between Newlon, Mont., and Buford, North Dakota, in connection with the Ft. Buford project, North Dakota and Montana.

This work involves the excavation of 1,587,500 cubic yards of material. The bids will be opened November 15, at Glendive, Montana.

The Secretary of the Interior has rejected all of the bids for the completion of the Gunnison Tunnel, Uncompahgre Valley project, and directed the prosecution of the work to be continued under the direction of the Chief Engineer of the Reclamation Service.

Three bids were received, and opened on September 26, that of J. G. White & Company, of New York City, for \$1,541,100, being the lowest.

Work on this tunnel has been carried on by force account since the failure of the Taylor-Moore Construction Company, nearly four months ago, and estimating on a basis of the actual cost of the work for that time, it is believed that the lowest bid is at least a quarter of a million dollars more than the completion of the tunnel should now cost, if extraordinary contingencies do not arise.

The Secretary of the Interior has executed a contract with Orman & Crook, of Pueblo, Colorado, for the construction of divisions 10 to 21, inclusive, of the south canal, Uncompahgre Valley project, Colorado.

By the terms of the contract the work must be completed within one year from the date of execution of contract by the Secretary of the Interior.

The Secretary of the Interior is advertising for bids for the construction of about 50 miles of the Interstate canal, North Platte project, Wyoming and Nebraska.

This work involves about 3,000,000 cubic yards of earthwork and 130,000 cubic yards of rockwork. The proposals are to be opened at the office of the U. S. Reclamation Service at Denver, Colorado, on November 8.

The Secretary of the Interior is advertising for proposals to furnish 10,000 barrels of Portland cement for the Interstate canal, North Platte project, Nebraska. The bids will be opened at Denver, Colorado, November 1, and should be for cement f. o. b. cars at stations on the Chicago, Burlington and Quincy Railroad (Guernsey Branch) between Torrington and Whalen, Wyoming.

Work on the Ft. Buford project, Montana and North Dakota, has reached a point where final plans and specifications for the Lower Yellowstone dam have been completed, and the Secretary of the Interior is advertising for bids for its construction.

This dam is to be a rock-filled timber-cribbed structure, requiring about one-half million feet of lumber, 700 piles, 1,600 sheet piles, 11,000 cubic yards of rock filling and riprap, and 100 tons of steel. It is to be located about 18 miles northeast of Glendive, Montana. The bids for its construction will be opened at Billings, Montana, on December 5, 1905.

Bids for the construction of the Shoshone dam were opened at Billings, Montana, on the 5th of September, by the board of consulting engineers convened for the purpose, and the lowest bid was found to be that of Prendergast and Clarkson, Chicago, Illinois.

Four proposals were received. The total amount of Prendergast and

Clarkson's bid for dam and auxiliary works was \$515,730.

The Secretary of the Interior has awarded the contract for the construction of eight miles of main distributing canal in connection with the Uncompahgre Valley project, Colorado, to Orman and Crook, of Pueblo, Colorado.

This work will involve the excavation of 525,000 cubic yards of material and the placing of 20,000 yards of concrete masonry for the conveyance and partial distribution of 1,300 cubic feet of water per second from the mouth of the Gunnison tunnel, near Cedar Creek, to a point on Uncompahgre River nine miles south of Montrose, Colorado.

By the terms of the contract the entire work is to be completed within one year. The amount of the bid is \$513,365.

Proposals to furnish from 30,000 to 40,000 barrels of cement for use in connection with the Yuma project, California and Arizona, were opened at Los Angeles, California, on September 30, and the bid of the Pacific Portland Cement Company, of San Francisco, was found to be the lowest:

The proposals were as follows:

Pacific Portland Cement Company, San Francisco, cement f. o. b. Yuma, \$2.819 per barrel.

Western Fuel Company, San Francisco, cement f. o. b. Yuma, \$2.881 per barrel.

Western States Portland Cement Company, Independence, Kansas, cement f. o. b. Yuma, \$2.960 per barrel.

California Portland Cement Company, Los Angeles, Cal., cement f. o. b. Yuma, \$3.0675 per barrel.



BEST USE OF THE WHITE MOUNTAIN REGION

The Preservation of Its Forests Demanded by all Far-seeing Citizens that Valuable Industries may Prosper

BY

H. J. ROBERTSON

IN 1888 Francis Parkman, the historian, sent a short article to the first number of *Garden and Forest* about the lumbering which was then going on in the White Mountains, in the course of which he said:

"New Hampshire is not a particularly wealthy state, but it has some resources scarcely equaled by those of any of its sisters. The White Mountains, though worth little to the farmer, are a piece of real estate which yields a sure and an abundant income by attracting tourists and their money; and this revenue is certain to increase unless blind mismanagement interposes. The White Mountains are at present unique objects of attraction; but they may easily be spoiled, and this yearly tide of tourists will thus be turned toward other points of interest whose owners have had more sense and foresight.

"These mountains owe three-fourths of their charms to the primeval forest that still covers them. Speculators have their eyes on it, and if they are permitted to work their will the state will find a most productive piece of property sadly fallen in value. If the mountains are robbed of their forests they will become like some parts of the Pyrennees, which though much higher, are without interest because they have been stripped bare.

"* * * A fair amount of good timber may * * * be drawn from the White Mountains without impairing their value. As the permanent

source of a vastly greater income from the attraction they will offer to an increasing influx of tourists. At the same time the streams flowing from them, and especially the Pemigewasset, a main source of the Merrimac, will be saved from the alternate droughts and freshets to which all streams are exposed that take their rise in mountains denuded of forests. The subject is one of the last importance to the mill-owners along the rivers."

We may be sure that if Parkman were living now his eloquent pen would be winning friends for the projected national reserve in the White Mountains; and although seventeen years have elapsed since he wrote in '88, he would find nothing to retract in what he then said. For, indeed, every word has been amply verified and illustrated.

In the first place this region of mountains and forests and streams, has developed so as a summer resort that it has become apparent that it is truly a "resource" for the people of a great deal larger territory than is comprised within the boundaries of the State of New Hampshire. It is sometimes said that this is no argument for a federal forest reserve and that it does not justify the outlay of federal funds which would be involved—or rather, it is said that it is the last and weakest argument, for no one denies it all force. But the truth is, that, as Parkman perceived it is one of the strongest arguments. Our oppor-

tunities for recreation and sport in the mountains and among the few remaining and accessible wildernesses are among the things which we as a nation greatly cherish and are justly proud of. America would not be America without them. As Dr. Edward Everett Hale said at the American Forest Congress last January: we "want our children's children's children to be able to sleep under such trees." And it is true that the White Mountain region is one of the three or four regions in this country which can be used for the purposes indicated by a large portion of the population. In the center of populous New England, within a few hours by train of New Jersey and all of eastern New York, hardly any farther from New York City than the Adirondacks and much nearer to it than the Maine woods, frequented by many who do not hesitate to call themselves westerners—this White Mountain region is already a national playground in fact. It is one of the nation's natural parks, in precisely the same sense, though not in the same degree, in which Switzerland is a playground and continental park for the whole of Europe. Witness to the truth of this—to look no farther—two things which are often cited now not as evidence, but simply as reasons: the first is an estimate that the summer tourist leaves more than \$8,000,000 in the White Mountains every year; the second is a petition to the Governor of New Hampshire to call a special session of the legislature to save the existing forests on the Presidential Range, which, though obviously forlorn and hopeless, and though circulated hurriedly at the end of this year's season, recently went to Concord with hundreds of tourists' signatures attached.

If the White Mountains are now a national park and playground and are this in fact, then there is really not so much a question of creating something anew, as of adopting measures to insure the perpetuation and indefinite enjoyment of a blessing which al-

ready exists. If the need exists there can be no question about the desirability of the measures except those of economy and expediency.

And the need does exist. Here again time and experience are amply verifying Parkman's words. The White Mountains are not snow peaks like the Alps. A great part of their charm and their value does lie in the forest cover on their sides, as does that of the hills in the Black Forest region in Germany, and although it is in a measure true that the second growth forest which comes up answers the purposes as well as forest primeval, it is also indisputable that unrestricted cutting and private ownership result in the complete destruction of the original forest as such, but in the extermination of all forest growth in situations and on exposures where no second growth worthy even of that more prosaic name will ever, within predictable decades, appear. Even where new woods immediately "come in" to replace the old, the existing conditions lead to a temporary destruction of the forest, to a disturbance and an arrest, which under public management would be recognized as not more unnecessary than undesirable. Such, for instance, is now the case with the famous Randolph forest on the northern slopes of the Presidential Range. If the very large lumbering operations which have been going on for the last two years continue this winter the whole tract, even to the upper slopes, will be cut over. Fire will be more than likely to follow the axe. This forest which has been one of the finest spruce growths in New England, standing in a beautiful situation, and yielding an annual crop of direct and indirect satisfactions, enjoyments, and profits to tourist, hotelman, railroad and mill owner, no less considerable because not easily expressed in dollars and cents, will cease to exist for all purposes but those of the most forlorn and uncertain sort of timberland speculation.

Not only is it further quite certain

that a fair amount of timber could be cut regularly from such lands without temporarily or permanently *destroying* the forest. The recent surveys and examinations by forest experts have only served to make this more clear; but even if such were not the case it would be proper and politic for the public to secure the safety and continued existence as such of an occasional accessible and not too immense body of primeval forest. Strictly commercial considerations are not the only ones, any more than other considerations are necessarily impractical. Although it is perhaps true that there will probably always be some primeval forest in New York and New England, there is serious danger that it may dwindle to an inferior or inaccessible and insignificant remnant, suggestive chiefly of regrets.

To a great and generous-minded nation such a situation would be forever lamentable; and on the other

hand if it were avoided, if a White Mountain forest reserve under public control were established, it would be unto all generations a thing rejoiced in and to be more and more proud of.

There are very many patiently practical reasons—both local and general—why a White Mountain forest reserve should be established, of which I am not now trying to speak. No one now questions the necessity of parks in our cities; and the older states have for years recognized and more or less acted on the principle that reserves and parks which no city or town could create or manage, must be maintained. So where the welfare of what is in substance a national park already is endangered, and one state cannot meet the emergency, it is for the nation to take the necessary steps. The circumstances differ principally in size, the thing is on a larger scale, but no new precedent is being created. The principle is the same.

THE FOREST SERVICE

Progress of Government Work in Forestry

CO-OPERATIVE WORK

Some idea of the scope of the co-operative work of the Forest Service with owners of timberlands, under the offer of co-operation outlined in Circular No. 21 of the Forest Service, may be gained from the figures showing the number of acres embraced in this work.

Since the offer of co-operation assistance has been asked for in the management of 11,269,000 acres. Detailed working plans have been made for tracts aggregating 858,000 acres, and are now being carried out upon them, the work being inspected from time to time by agents of the Service. Working plans are now in preparation for 2,950,000 acres more, while preliminary examinations have been made for 2,576,000 acres. Timber tract applications are now on hand for an area

of over 1,154,000 acres, and examinations of the tracts are being made as rapidly as possible.

In addition to the timber tract work, examinations have been asked for for over 32,000 acres of woodlots. These tracts average from 10 to 100 acres in size. Of this area 20,790 acres have already been examined and detailed reports sent to the owners. A large percentage of the tracts are now under forest management.

MINING COMPANY INTERESTED

An agent of the Forest Service has just returned to Washington after having completed the field study for a working plan, which the Service is preparing for a mining company in Kentucky.

The company's lands, which are coal

lands, comprise about 7,100 acres, all but 640 acres of which are virgin hardwood forests of typical Southern Appalachian character, in which chestnut, chestnut oak, yellow poplar, white oak, and basswood are the leading trees. Black walnut is also present in some quantities. The study of the tract has occupied five men for about three months. The owners, whose first object is the development of the coal mines, desire to manage their forest capital so as to make it also yield interest, and the working plan which they have requested has in view the production of mine props construction timber for the mining plant, and its upkeep, and material for cars and other similar needs of the mines.

A feature of the working plan is the provision for reforesting the 640 acres already cleared. Trees will be planted, so that the highest productiveness of the land may be assured for the future. Twenty acres of black walnut are being planted this fall, and each year a given area will be planted to black walnut, hickory, chestnut, and chestnut oak.

WORKING PLAN FOR SOUTHERN TIMBER

The E. P. Burton Lumber Company, of Charleston, South Carolina, for which the Forest Service prepared a working plan some two years ago, has asked the Service to prepare a new plan of the same character for the management of 30,000 acres in Berkeley county.

As soon as the first plan had been in force long enough to be tested, the company declared itself heartily in favor of its recommendations, and set aside the sum of \$3,000 per annum to carry them out in the fullest degree. The experience of two years has, further, so far confirmed it in this course that the second plan is now called for.

On November 1 six men, assigned by the Forest Service to make a detailed study of the tract, will go to South Carolina for this purpose. This

tract consists of 30,000 acres of long-leaf and loblolly pine, which it is desired to manage with all the thoroughness and care which have borne such good fruits in the management of the former tract. A mill-scale study will also be made, at the company's request, with a view of fixing the diameter at which trees yield the best paying grades of lumber at the mill.

The advisability of fixing the diameter limit of trees to be cut relatively higher, so as to allow for the better quality and consequent greater profit in the mill product, is one which is receiving more attention from lumbermen and foresters than ever before.

The E. P. Burton Company employs two foresters, Mr. C. S. Chapman and Mr. Max Rothkuegel, who have in charge the proper execution of the working plans.

FOREST PRODUCT STATISTICS

Every prospect seems to favor the success of the study which the Forest Service is making of statistics of forest products in the United States. The hearty co-operation of the National Lumber Manufacturers' Association, which is collaborating with the Service, will be a strong factor, since the members of this association produce about one-third of all the lumber manufactured in the United States. Agents of the Forest Service in the west and in New York and New England have conferred with lumbermen and with the officers of manufacturers' associations, and have everywhere been met with interested aid.

The object of this study is one which strongly appeals to all those whose business depends upon wood as raw material. The census returns every ten years, and more recently the figures which Congress has authorized to be gathered every five years, are still felt to be too infrequent to satisfy the need of current knowledge of demand and supply in the lumber market. The effort toward economy in cut and in manufacture, which the reduction of supply and the rise in

umpage prices is making yearly more needful, calls for detailed information as to the output of mills and the utilization of their products. It is this information which the study of the Forest Service aims, with the co-operation of those interested, to secure for publication.

USE OF FOREST RESERVE TIMBER

The freer use of the resources of the national forest reserves, which is the policy of the present administration to encourage, is welcomed in the west, where it is best understood. Applications for the purchase of timber, aggregating 3,400,000 feet, have just been received by the Forest Service for timber standing on three recently created reserves. Two applications for timber on the Henrys Lake Forest Reserve, in Idaho, are for 1,700,000 and 200,000 feet of lodgepole and western yellow pine respectively. Another application is for 1,000,000 feet of timber, a large percentage of which is dead, on the Holy Cross Reserve, in Colorado. The third is for 100,000 feet of dead and insect-infested timber on the Pike's Peak Reserve, in the same state.

When it is remembered how much opposition was once felt to the establishment of forest reserves in these regions, on the ground that the resources of reserved forests would be withheld from use, these offers for timber strikingly indicate the progress which has been made, both in sentiment toward the reserves and in the better understanding of their object. With the opening of the reserves to the fullest use consistent with the lasting productiveness and protective value of the forest, the last trace of public misapprehension as to their need and value has practically vanished.

PRIVILEGES. ASSIGNMENTS AND TRANSFERS

The following privileges have been granted by the Forest Service: To James C. Yandell, of Clearwater, Ida-

ho, permission to conduct the way station formerly conducted by C. A. Thompson, at a point known as the Mountain House, in the Bitter Root Forest Reserve, Idaho; to W. A. Lister permission to conduct a way station on the Stites and Elk City Wagon Road, at a point known as Corral Hill, in the Bitter Root Forest Reserve, Idaho; and to Edwin W. Lee, F. J. Barber, and James W. Lee, permission to construct a trail in the Grand Canyon Forest Reserve, Arizona, from Comanche Point on the south rim of the Grand Canyon, to a point opposite the terminal of the old trail on the north rim of the Canyon.

Robert W. Reed has been appointed Forest Guard on the Gila River Forest Reserve in New Mexico.

Permission has been granted to Edward Coughran, of Piute, California, to occupy two acres of land in the Sierra Forest Reserve upon which to erect a small arrastra for extracting mineral from ore taken from his adjoining mining claim; to D. E. Schnebly, of Sedonia, Arizona, permission to occupy ten acres of land in San Francisco Mountains Forest Reserve for agricultural purposes; and to J. H. Stevens, of Kalispell, Montana, permission to occupy one acre of land near the head of Lake McDonald, in the Lewis and Clark Forest Reserve, and to construct a log cabin there for use as a summer home.

W. N. Noffsinger, of Kalispell, Montana, has been granted permission by the Forest Service to occupy one acre of land in the Lewis and Clark Forest Reserve for the purpose of a summer residence.

The J. H. McShane Lumber Company, with headquarters at Ranchester, Wyoming, is the successful bidder for the purchase of a large amount of timber in the Big Horn Forest Reserve. The price bid was \$2.50 per thousand feet, and the total amount of the purchase is approximately \$125,000. This is by far the largest sale of government timber so far made at so advantageous a price.

Harold Marshall, Forest Guard in the Pinal Forest Reserve, in Arizona, has been appointed manager in charge of that reserve, to relieve Forest Inspector R. E. Benedict, who will now proceed with inspection work on the reserve in southeastern Arizona.

Sylvanus Collett, deputy forest ranger of the Uintah Forest Reserve, has been appointed ranger in charge of the new Dixie Forest Reserve, in Utah, which was proclaimed on September 25, and which will be placed under administration as soon as possible.

Otto W. Haeger, Forest Guard in the Santa Barbara Forest Reserve, has resigned from the Forest Service.

Forest Inspector Smith Riley, of the Forest Service, temporarily in charge of the Holy Cross Forest Reserve, in Colorado, which has been only a short time created, has forwarded to the Forester applications for timber sales amounting to approximately 1,000,000 feet of timber, and his reports indicate that there is prospect of immediate increase of such business on the reserve.

M. J. Adair, of Tropic, Utah, has been granted permission by the Forest Service to occupy ten acres of land in the Aquarius Forest Reserve for agricultural purposes.

Alicia D. Conrad, of Kalispell, Mon-

tana, has been granted permission by the Forest Service to occupy one acre of land in the Lewis and Clark Forest Reserve, and to erect a cabin thereon for use as a summer home.

Mr. Sewel Tibbetts has been appointed ranger on the Cass Lake Forest Reserve, in Minnesota.

Forest Ranger Fred. J. Boller, of the Bitter Root Reserve, in Idaho, has resigned from the Forest Service.

Mr. V. Gifford Lantry, Forest Ranger of the Shoshone Division of the Yellowstone Forest Reserve, Wyoming, has resigned.

The following privileges have been granted by the Forest Service: To Daniel Stukey, of Steamboat Springs, Colorado, right of way for ditch in the Park Range Forest Reserve, Colorado; to H. A. Harvey, of "Harvey's Resort," New Mexico, permission to use buildings for carriage house and barn, within the Pecos River Forest Reserve; and to John R. Barnes, of Mesa, Colorado, right of way for three storage reservoirs in the Battlement Mesa Forest Reserve.

Forest Ranger A. R. Swarthout, of the San Bernardino Forest Reserve, has resigned from the Forest Service.

The resignation of Forest Ranger Patrick Britt, Pikes Peak Forest Reserve, Colorado, has been accepted by the Forest Service.

DEPARTMENT OF THE INTERIOR, Washington D. C., October 5, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Chamber of Commerce Building, Denver, Colo., until 2 o'clock, p. m., November 8, 1905, for the construction of about 50 miles of main canal, involving about 3,000,000 cubic yards of earthwork and 130,000 cubic yards of rockwork, for the irrigation of lands in the North Platte Valley in eastern Wyoming and western Nebraska. Specifications, forms of proposals, and plans may be inspected at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., and at the office of the Reclamation Service, Denver, Colo., and Mitchell, Nebraska. THOS. RYAN, Acting Secretary.

DEPARTMENT OF THE INTERIOR, Washington, D. C., October 6, 1905. Sealed proposals will be received at the office of the Engineer, United States Reclamation Service, Chamber of Commerce Building, Denver, Colo., until 3 o'clock p. m., November 8, 1905, for the construction of concrete culverts, siphons, drops, flumes, wasteways, bridge abutments, etc., and furnishing 10 combination highway bridges, and 570,000 pounds steel. Total amount of concrete about 10,000

cubic yards. Above work to be done along the line of the Interstate Canal from Whalen to Torrington, Wyo., in connection with the North Platte project, Nebraska. Specifications, form of proposal and plans may be obtained at the office of the Chief Engineer of the Reclamation Service, Washington, D. C., or from John E. Field, Engineer, Reclamation Service, Denver, Colo., or Wyncote, Wyo. E. A. HITCHCOCK, Secretary.

DEPARTMENT OF THE INTERIOR, UNITED STATES GEOLOGICAL SURVEY, RECLAMATION SERVICE, Washington, D. C., September 7, 1905. Sealed proposals will be received at the office of the United States Reclamation Service, Billings, Montana, until 2 o'clock p. m., December 5, 1905, for the construction of the Lower Yellowstone Dam, a rock filled timber cribbed structure, requiring about one-half million feet of lumber, 700 piles, 1,600 sheet piles, 11,000 cubic yards of rock filling and riprap, and 100 tons of steel, located about 15 miles northeast of Glendive, Montana. Plans, specifications and proposal blanks may be obtained from the Chief Engineer, United States Reclamation Service, Washington, D. C., or from Frank E. Weymouth, Engineer, Glendive, Montana. THOS. RYAN, Acting Secretary.

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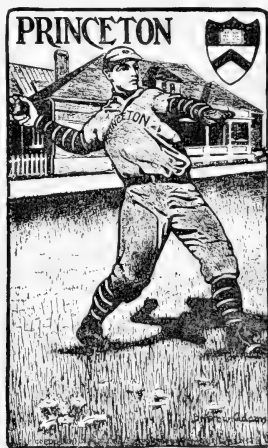
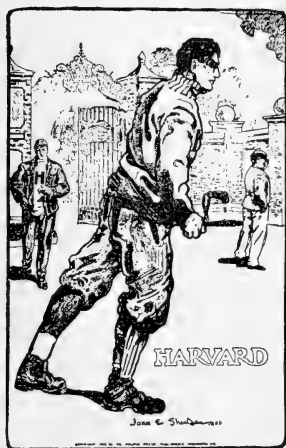
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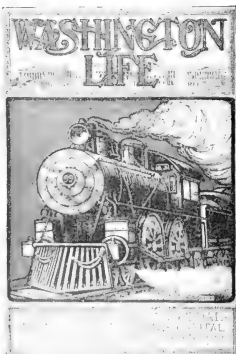


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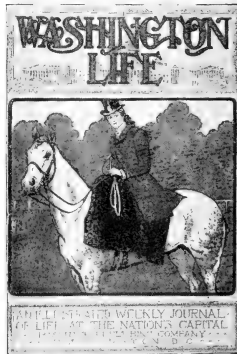


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Forestry and Irrigation

H. M. SUTER, Editor

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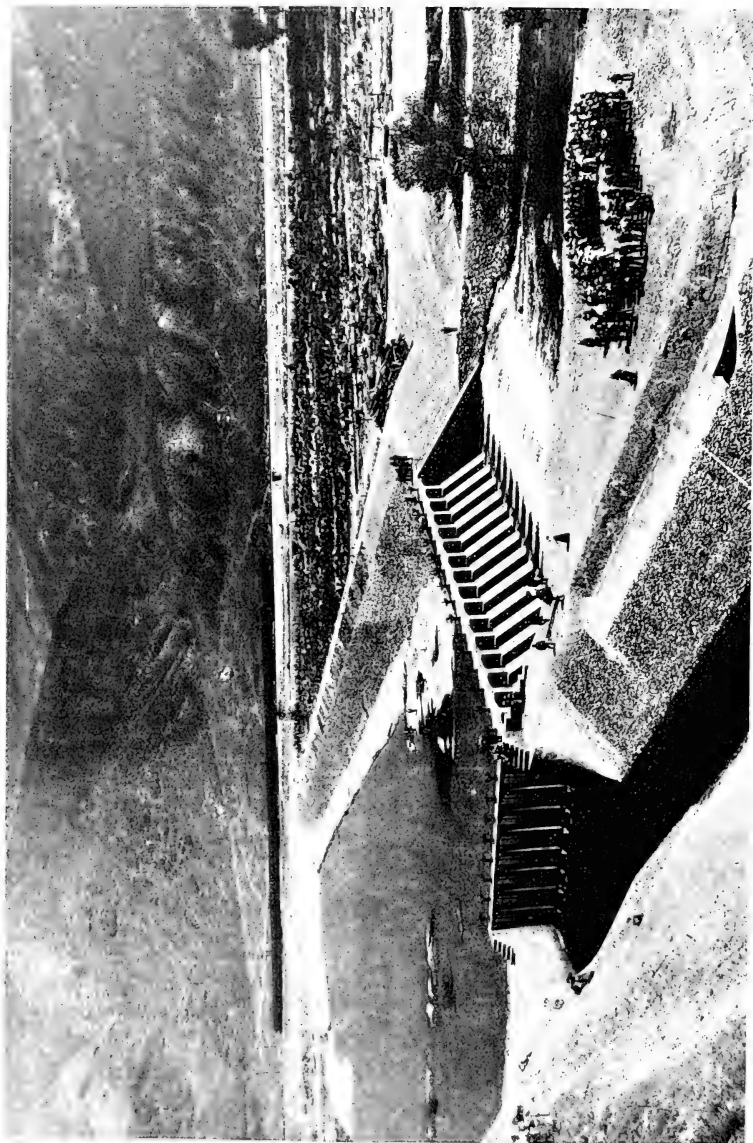
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VIEW OF A GREAT NATIONAL IRRIGATION PROJECT

Congressional party gathered in circle during the opening of the newly completed headworks of the main Truckee Canal, Nevada.

Forestry and Irrigation.

VOL. XI.

DECEMBER, 1905.

NO. 12

NEWS AND NOTES

The January Meeting

The attention of the members of the American Forestry Association is called to the announcement elsewhere in this number of the two-day meeting of the organization to be held in Washington on January 16 and 17. Matters of wide importance will be discussed and it is hoped that there will be a good attendance. All persons interested in forestry, whether members of the Association or not, are invited to attend this meeting. The sessions will be held at the New Willard Hotel.

Educational Use of Reserves

In his article on the White Mountain Forest Reserve, on another page, Professor Rane touches upon a very important side of this forest reserve question—that is, the educational value of these great national forest reserves, administered by the trained men of the national forest service. No mere state reserve, no private work, can provide such an object lesson in the larger work and purposes of forestry. At present this privilege is confined to the large and thinly populated states of the great West, but it is needed in even greater degree in the more thickly settled East, where the forests are rapidly waning and the question of economical management and preservation has become a vital and immediate one. There are few areas left east of the Mississippi that require or admit this national management on a large scale. Of these few the proposed Southern Appalachian and White Mountain reserves are the chief—and now is the time for the nation to secure them.

Canadian Forestry Convention

On January 10, 11 and 12, at Ottawa, will be held a Canadian Forestry Convention under the auspices of the Canadian Forestry Association. The official call for the convention was issued on August 21, by the Right Honorable Wilfrid Laurier, Premier of the Dominion, and since that time the Canadian Forestry Association has been engaged in arranging for the greatest and most representative meeting of its character that has ever been held in the Dominion. Discussion of subjects at the convention will be under the following divisions: (1) The Nation and the Forest; (2) Forestry in Relation to Agriculture and Irrigation; (3) The Forest and the Lumber and Pulp Industries; (4) The Relation of Our Forests to Our Other Industries: Railways, Water-powers, Mining, Building Trades, Wood-working Manufactures; (5) Scientific Forestry and Forestry Education.

In organization, the convention is to be modelled on much the same lines as the American Forest Congress (held in Washington last January) was; delegations are to represent all industries allied to forestry and the forests, and all interested organizations and societies are to be represented. Mr. Gifford Pinchot, Forester, U. S. Forest Service, will be present, representing the United States Forest Service, and it is probable that a number of the members of the American Forestry Association will also be present.

Forest Fish and Game Exhibit

The New England Forest, Fish and Game Exhibition, to be held at the Mechanic's Building, Boston, Mass.,

December 25 to January 6, promises to be of more than ordinary interest. Considerable attention is to be devoted to the forest exhibits, including displays illustrative of tree culture; forest botany, seeds, insects injurious to the forest, native woods, forest industries, forest instruments, etc. Part of the government forestry exhibit formerly shown at the Lewis and Clark Exposition has been loaned for the occasion; and in addition the Canadian government, and Provincial governments are to be well represented by generous exhibits, not only of forest resources, but also of specimens of food and game fish and animals, birds, insects, trade exhibits, and a large number of transparencies, photographs, drawings, paintings, etc., of out-of-door subjects.

Lessening Engineering Force

With the approach of winter a large number of engineers and assistants in the Reclamation Service are being laid off or given furloughs. There is a considerable demand, however, for these men, especially the active and experienced, and they find employment elsewhere, particularly on the new railroads now under construction or in the development of power and irrigation enterprises by private capital in the West.

The reason for dispensing with the services of these men is because the preliminary or reconnaissance stage of the work has been passed. Most of the important irrigation projects in the West have been examined, and the Secretary of the Interior has made a selection of the most meritorious. The engineering plans for these are practically completed or have reached a stage where construction has been begun or will soon be initiated.

As the construction work is usually done by contract, fewer government engineers are required under each project in the later stages of the work.

There are also a number of projects which the Secretary is holding under consideration, and which may not be authorized in the near future. In-

structions have been given to close down the work under these projects, with the exception of perfecting the details in hand, in order that no time will be lost in taking up the work again whenever it has been approved.

North Platte Project

The work of construction on the North Platte project is progressing satisfactorily, notwithstanding some difficulty has been experienced by the contractors in securing laborers. On Division No. 1 a total excavation of 59,000 yards has been made, leaving 281,000 yards to be moved during the next five months. This will require a force of about sixty teams constantly on the work.

On Division No. 2 about 50 per cent of the yardage, or 151,000 yards, have been moved, and by employing the present force of laborers with seventy-six teams, this division of the work will be completed in two or three months.

On Division No. 3, which was sublet to Orman & Crook, the excavation to date amounts to 46,000 yards, leaving 230,000 yards of class one and 60,000 yards of class two and four material.

On Division No. 4, in charge of the Deadwood Construction Company, a total yardage of 65,650 has been moved, leaving a balance of 126,000 yards which will be completed by April 1.

On Division No. 5, under Orman & Crook, a total yardage of 143,000 has been moved, leaving a balance of 200,000 yards which can be completed by April 1 with forty teams. On this division all of the work is heavy cutting and filling, and in order to complete within the period of the contract the present force will have to be increased. No work has been done on Divisions 6 and 7.

James O'Connor, contractor on Division 8, has moved 62,000 yards out of a total of 292,000, and expects to complete the contract in time for the irrigation season of 1906.



View Showing a Stretch of Irrigable Lands that have been filed upon and Homesteaded under the Main Truckee Canal, Nevada; Five Miles Southeast of Wadsworth, Nevada.



View Showing Farm Lands Surrounding Wadsworth, Nevada, Embraced in the Truckee-Carson Project.

No work has been done on Divisions 9 and 10. To complete the contract it will require one hundred and fifty teams.

Work on the government camp at Wyncote is well under way, and during the coming month it is expected that all of the buildings and sewer systems will be completed.

Dike Building at Yuma

The Secretary of the Interior has authorized the

U. S. Reclamation Service to proceed by force account to construct a portion of the great dike which is to be a part of the Yuma project, Arizona and California.

This authorization was given as the result of an injunction, which was granted by the owners of land upon which the dike is to be built, against the contractors. As the land involved was patented subsequent to October, 1888, it is subject to the right of way for canal construction by the authority of the United States, and the government, therefore, cannot be enjoined for the construction of a canal with dike protection therefor.

The work of the contractors will be diminished to the extent of the work performed by the government. The land owners are represented in Washington by former Senator George H. Turner, of Washington.

Future Labor Supply

The question of labor supply in the arid West is one of the most serious

matters now confronting the engineers of the Reclamation Service. A number of small contractors have already failed because of the difficulty of obtaining labor, and others are on the verge of failure because they cannot obtain a sufficient number of workmen; nor are they able to secure the services of competent sub-contractors and foremen.

When the contractors are not able to keep up with the work it becomes necessary for the Reclamation Service to step in and push the work themselves, and to pay if necessary larger wages for good men. As a result of the enormous increase of railroad con-

struction, laborers are not only very scarce, but very independent, and drift about from place to place after brief stops on each job. At all the labor centers extra inducements are being offered for good men. Car load after carload of laborers is started for the West, and every effort made to deliver the men, but in spite of great vigilance many of the men succeed in getting away before the destination is reached. They have enjoyed their little picnic and are not hankering for the real work. Some of them actually stay a few days and then drift on, while a very few remain on the job and appear to take a human interest in it.

One very difficult item to cope with in government work out in the arid region is the eight-hour provision, especially during the long hot days. Every man who is exercising moderately out in the sun with his attention distracted from the heat gets along with a reasonable degree of comfort, and it is only when he is compelled to sit around that he begins to appreciate the conditions. The long hours of enforced idleness, with absolutely nothing to do, away from every amusement, causes the men to think of little except drink, and in spite of every reasonable precaution bad liquor gets into every camp.

Many of the best workmen insist that under these conditions they would prefer to work longer hours and keep occupied except during the time needed for eating and sleeping. Having no home to go to and no place to stay except in the crowded bunk house, they quickly get discouraged.

Peculiar Flood Results

Its an ill flood that does

no one good in southern

California. The keen-

ness with which the desert dweller goes after water was never better illustrated than in a recent case before one of the Departments.

It is the case of a number of settlers filing upon the waters of a slough, which was formed by the recent disastrous floods on the Colorado River,

and then seeking to enjoin a canal company from its endeavor to repair the damages which high water had caused to its canal system. The Colorado River, which burst its banks last summer, has been spilling over the sunken desert known as Imperial Valley, and has created a great inland sea that threatens to overwhelm several thousand homes, destroying millions of dollars of property. Along one of its flood channels it passes through an old slough, and certain settlers not unaware of the source of the water, but mindful of its great value in the desert, filed upon the slough, attaching thereby to themselves in perpetuity, in accordance with the laws of the state of California, a prior right to the use of these waters.

Meanwhile the canal company has been strenuously engaged in an effort to restrain the boisterous river within its proper banks. Every round thus far has been in favor of the river. Remarking these efforts the settlers who claim the slough have appealed to Uncle Sam to restrain the company, claiming that their present efforts threaten the supply of water in the slough.

Funds for Umatilla Project

The Secretary of the Interior has set aside the sum of \$1,000,000 from the reclamation fund for the construction of the Umatilla project in Oregon, and has given authority for proceeding with the project with a view to its construction.

The approval is based upon the following conditions: First. That a satisfactory agreement or agreements be obtained from the owners of private property for the acquisition of such property as may be necessary or required for the proper construction of the project, and that no part of the moneys appropriated shall be expended for construction purposes or for the acquisition of any canals, laterals, or other property until such satisfactory agreement or agreements have been obtained and approved by the Secretary of the Interior.

Second. That sufficient acreage of land under the project be pledged to the return to the reclamation fund of the moneys appropriated.

Montana Reclamation

A request has been received by the Reclamation Service through Senator Clark, from the Red Lodge Board of Trade, Montana, that an investigation be made of certain areas tributary to Clarke Fork River, with a view of ascertaining the feasibility of constructing an irrigation project in that section. Owing to the fact that it is certain canal construction and the necessary storage system would involve a very large expenditure, the settlers in the valley are extremely desirous that the government should take up the construction of the work, as it is apparently beyond private capital.

The area desired to be investigated has already received the attention of the Reclamation Service engineers, and their report will appear in the forthcoming Annual Report of the Reclamation Service, which is now being prepared for Congress. The valley of the Clarke Fork River is contiguous to that section in northern Wyoming which is embraced in the Shoshone project, and when the state of the reclamation fund will permit the construction of other works in Montana, it is probable that the Clarke Fork enterprise will receive further consideration. At the present time, however, the condition of this fund is such that it will be impossible to construct any portion of this or of several other meritorious projects in Montana. Nearly 9 per cent of the entire reclamation fund has been allotted for works in that state, and from this time the efforts of the Service must be concentrated on the early completion of the projects which have been selected and approved for construction.

Investigations in Montana up to the present date show that the entire reclamation fund of \$30,000,000, if devoted to Montana alone and not spent in any other state, would not be sufficient for

the completion of the many excellent projects available. With the reclamation fund entirely allotted, the government engineers for the next three years will be busied in actual building, and will therefore be unable to give further consideration to other projects in Montana.

Tree Growth in South The field of work of the Forest Service, carried on for the past year in the Southern Appalachian forests, is now finished. During the past few months a party of six men has been engaged in collecting figures showing the volume and growth-rate of chestnut oak. This study completes the data required by the Service.

The results of this investigation will be used to determine the best system of forest management for these forests, and also to show approximately the stand of timber remaining. In case a national forest reserve is created in this region the facts gathered in this study will be of great value in managing the timber lands conservatively.

Special Uses of Wood In connection with the studies of woods for special uses, which the Forest Service is carrying on, Mr. C. L. Hill, of the Service, is now in New York, where a good deal of wood paving is being laid, in order to study the operation of laying and to confer with engineers; and Mr. H. B. Holroyd is making a trip through Indiana, Illinois, and Wisconsin, investigating vehicle woods. The specific objects which Mr. Holroyd has in view on this trip are the selection of various woods to be tested for their adaptability for vehicle and implement manufacture, and to arrange for co-operative studies of such woods, shared by the Forest Service and manufacturers.

Southern Forest Studies Mr. K. W. Woodward, of the Forest Service, has gone to Georgia to make a preliminary examination of a tract of 2,500 acres of pine land, for which the owners have asked the For-

est Service to prepare a working plan according to the usual plan of co-operation. After finishing work on this tract, Mr. Woodward will go to Florida to make a similar examination of over a million acres of pine land.

During the winter Mr. Woodward will be engaged upon a study of the red cedar in the South. Red cedar is the best wood for the manufacture of pencils, for which a soft wood of straight grain, free from imperfections, is necessary. A study of this tree will supply valuable information concerning its growth, distribution, and forest habits, which will serve as a basis for the application of forest management to cedar forests, and thus help to make permanent the supply.

Turpentine Work Mr. George B. Sudworth, dendrologist of the Forest Service, recently made a trip to inspect the progress of the new turpentine investigations which the Service is carrying on in co-operation with the Hilman-Sutherland Land Company, near Jacksonville, Florida. These investigations are designed to test an improved system for scarifying trees for turpentine.

Some two years ago, as the result of a study by the Forest Service, there was perfected a new system of turpentine called the "cup-and-gutter" system, which does away with the earlier practice of cutting deep boxes in the bases of the trees and very materially lessens the injury done to the trees, so that much is gained in economy of production. Yet with this system, as with older systems, large faces are chipped on the trunks, causing wounds which limit the productive life and vitality of the trees. The turpentine industry, like the lumber industry, is so extensive that there is need to use all possible economy, and the present experiments which the Forest Service has under way are designed to prolong the productive life of trees worked by the use of a new method of chipping, without, it is hoped, reducing the average annual yield.

View Showing Government Buildings at Hazen, Nevada; Truckee-Carson Reclamation Project.



NEED

The Forest Service is a part of the Department of Agriculture, and its work is to manage the Nation's forests for the benefit of the people. It is a service which is essential to the Nation's health and well-being, and it is a service which is essential to the Nation's economy. The Forest Service is a service which is essential to the Nation's health and well-being, and it is a service which is essential to the Nation's economy. The Forest Service is a service which is essential to the Nation's health and well-being, and it is a service which is essential to the Nation's economy.

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for two years more and finally transferred to the National Forest Service.

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MEETING OF THE AMERICAN
FORESTRY ASSOCIATION

Figure 1 consists of two Western blot panels, A and B, showing p38 phosphorylation. Panel A shows a Western blot with lanes for 'Control', 'LPS', and 'LPS + SB'. The 'LPS' lane shows a strong band for p38 phosphorylation, which is significantly reduced in the 'LPS + SB' lane. Panel B shows a Western blot with lanes for 'Control', 'LPS', and 'LPS + SB'. The 'LPS' lane shows a strong band for p38 phosphorylation, which is significantly reduced in the 'LPS + SB' lane. The blots are probed with anti-phosphorylated p38 antibody.

[illegible]

THE PRESIDENT ON PUBLIC LANDS, IRRIGATION AND FORESTRY

Gives Marked Attention to These Subjects in His Last Message to Congress.

ONCE again I call your attention to the condition of the public land laws. Recent developments have given new urgency to the need for such changes as will fit these laws to actual present conditions. The honest disposal and right use of the remaining public lands is of fundamental importance. The iniquitous methods by which the monopolizing of the public lands is being brought about under the present laws are becoming more generally known, but the existing laws do not furnish effective remedies. The recommendations of the Public Lands Commission upon this subject are wise and should be given effect.

The creation of small irrigated farms under the Reclamation Act is a powerful offset to the tendency of certain other laws to foster or permit monopoly of land. Under that act the construction of great irrigation works has been proceeding rapidly and successfully, the lands reclaimed are eagerly taken up, and the prospect that the policy of national irrigation will accomplish all that was expected of it is bright. The act should be extended to include the state of Texas.

The Reclamation Act derives much of its value from the fact that it tends to secure the greatest possible number of homes on the land, and to create communities of freeholders—in part by settlement on public land, in part by forcing the subdivision of large private holdings before they can get water from government irrigation works. The law requires that no right to the use of water for land in private ownership shall be sold for a tract exceeding 160 acres to any one land owner. This provision has excited active and powerful hostility, but the

success of the law itself depends on the wise and firm enforcement of it. We cannot afford to substitute tenants for freeholders on the public domain.

The greater part of the remaining public lands cannot be irrigated. They are at present and will probably always be of greater value for grazing than for any other purpose. This fact has led to the grazing homestead of 640 acres in Nebraska and to the proposed extension of it to other states. It is argued that a family cannot be supported on 160 acres of arid grazing land; this is obviously true. But neither can a family be supported on 640 acres of much of the land to which it is proposed to apply the grazing homestead. To establish universally any such arbitrary limit would be unwise at the present time. It would probably result on the one hand in enlarging the holdings of some of the great land owners, and on the other in needless suffering and failure on the part of a very considerable portion of the *bona fide* settlers who give faith to the implied assurance of the government that such an area is sufficient. The best use of the public grazing lands requires the careful examination and classification of these lands in order to give each settler land enough to support his family and no more. While this work is being done, and until the lands are settled, the government should take control of the open range, under reasonable regulations suited to local needs, following the general policy already in successful operation on the forest reserves. It is probable that the present grazing value of the open public range is scarcely more than half what it once was or what it might

easily be again under careful regulation.

The forest policy of the administration appears to enjoy the unbroken support of the people. The great users of timber are themselves forwarding the movement for forest preservation. All organized opposition to the forest reserves in the West has

disappeared. Since the consolidation of all government forest work in the National Forest Service there has been a rapid and notable gain in the usefulness of the forest reserves to the people and in public appreciation of their value. The national parks within or adjacent to forest reserves should be transferred to the charge of the Forest Service also.

THE FOREST SITUATION IN NORTHERN NEW HAMPSHIRE

BY

GEORGE T. CRUFT

President of the White Mountain Board of Trade, and Treasurer of the Society for the Protection of New Hampshire Forests.

THE manufacture of paper from spruce has made very great changes in the forest situation in northern New Hampshire during the last ten years. Cities of 12,000 inhabitants, like Berlin, N. H., have sprung into existence. Lincoln, N. H., is another young city. The older towns, like Littleton and Lancaster, have felt very strongly the impetus. The total capital invested in twenty-nine paper and wood pulp plants is rated in the twelfth census of 1900 at \$8,163,081, paying annually in wages \$1,036,856, and turning out an annual product of the value of \$7,244,733. These astonishing figures do not include the saw mills and other manufacturing plants aside from the paper and pulp industries, nor do they include the very active logging operations in the woods. Two paper mills of the largest capacity have been put in operation within the last three years. Not only New Hampshire, but all New England, feels the stimulus of this new and prosperous business.

With this advance, it is not surprising that the values of spruce lands have greatly advanced. A rise of more than 50 per cent has occurred during the decade, and prices are likely to go still higher, for we learn from

the report which the United States Forest Service has recently made on northern New Hampshire that there are standing 4,764,000,000 feet board measure of coniferous timber. This is mostly spruce and fir. The annual cut is given as 225,000,000 feet. If there were no new growth, therefore, and no importations from Canada and elsewhere, the supply would last twenty-one years. The annual growth in the forest is large, and 37 per cent of the amount needed is already imported from Canada; but there is a constantly increasing demand with a correspondingly larger output which tend to make the time of exhaustion nearer at hand. With the constant growth in population of the country it is inevitable that the output must be larger.

It is not surprising, therefore, that those who know and love the White Mountains should be anxious lest the beauty of the mountains be spoiled. Inquiries come from all parts of the country, not only from those who formerly lived in New Hampshire, but also from that much larger number who have visited its places of rest and recreation, particularly from the Middle West: What can we do to help the reservation in the White Mountains?

The White Mountains have long served to make life more tolerable to many thousands of busy men and women—the brain workers of the country. The forests in places of special beauty throughout the mountains are more serviceable to mankind by standing than by being ground into paper pulp for a day's convenience in reading the news. The movement to protect the forests is already too late to do its most effective work. Some of the forests most valuable because of their attractive location have been cut away during the last three years, and this, too, on the Presidential Range, where, of all places, the axe should be retrained.

There remain but two primeval forests on the Presidential Range. The Randolph forest is the one referred to above as having been partly cut away. It was twelve miles long and four miles wide, extending over the northern sides of Jefferson, Adams, and Madison, stretching up to 4,000 feet above the sea, and from it rose the majestic peaks of the Presidential Range. Four hundred men cutting for three winters, distributed throughout the forest in eight camps, have done irreparable damage. But there remains the most beautiful portion of it, at the eastern end, up the famous "Valley Way" between Mt. Adams and Mt. Madison. Two new camps have just been put in to cut this off, also, during the coming winter. Only immediate action will be of any avail.

The other primeval forest on the Presidential Range is on the southern slopes of Mount Washington, in the vicinity of the Pinkham Notch. Although less accessible and somewhat less attractive, it has wonderful beauty, and appeals to the imagination. This property is on the market and in danger of being cut off.

In other parts of the White Mountains there remain a few pieces of primeval spruce, which, because of their attractive location, should be reserved for higher service. The northern slopes of the Franconia Mountains have late-

ly been cut over. Within a year, in and about the Notch, ugly slashes have been made. On the southern slopes the mountains have generally been cut over more heavily, and the tracts of primeval timber that remain are therefore more important. Valuable pieces of timber occur also in the Dixville Notch, and surrounding the second of the Connecticut lakes. Words cannot be used too strongly in urging the preservation of these remnants of the primeval forest.

But it is not alone for the primeval forest that New England desires a national reservation in the White Mountains. To make continuous, through judicious cutting, the industries previously mentioned, and to protect the headwaters of every important river in New England, save one—these are the strong economic reasons for the reservation. It is desirable and, if the reservation is to be effective, necessary, that the United States Government acquire not only the pieces of virgin forest remaining, but also large areas of cut-over lands, in order to put them under forest management. This is the only means of preventing the tremendous losses by fire and by erosion which have already rendered completely and permanently barren 84,000 acres in the mountain regions that were formerly covered with forest growth. One of the most interesting features of the proposed reservation is that, if the cut-over lands are put under forest management for the purpose of future commercial returns, they become at the same time far more attractive. It is a case of having one's cake and eating it, too.

There is no possibility of adequate action except by the United States Congress. The interests involved extend far beyond New Hampshire—the interests and prosperity of New England are concerned. New Hampshire will do her part, as much, and more, than any other state in proportion to her population and wealth. The state already has caused to be made a complete survey of the mountain region by

the Forest Service at Washington. To secure this reservation in the White Mountains, all New England should unite, and all friends of the White

Mountains throughout the country may extend the agitation and urge their congressmen to vote for these measures.

IRRIGATION IN THE NORTH PLATTE VALLEY

BY

ROBERT TUDOR HILL

IF IN any phase of economic life man is the creator of his circumstances, it certainly is true in a good system of irrigation. Then he is his own rain-maker, in a sense of the word, and, provided the good Lord fills the river upon which the water system depends, the irrigation farmer is a comparatively independent individual. Rain or shine, wet or dry, wind or calm, it makes but little difference; if he can get the water, he is a happy man.

Modern irrigation systems are not widely different from those of ancient and medieval times, whose traces may be found in many places; but they have been so highly developed, and made so completely adequate to the needs of man, that we can easily forget that we have only developed an old idea. Irrigation, in itself, is the salvation of a country which has little or no rain, for it turns land absolutely worthless, because dry and barren, into blooming and productive fields, and consequently raising land values from practically nothing to many dollars per acre. A single irrigation system is like an inverted river system. The water of the river flows from a diminutive source to a wide mouth, the volume being increased by tributaries. The ditch water, however, flows from a wide mouth until it is lost in the fields, while the laterals draw from, instead of contributing to the system.

The North Platte valley is not very wide; in fact, it is simply the flood plain of the present river, which, by

the way, is never flooded, and which, in early geological times, was the actual basin of a large river. It varies in width from four or five miles to twelve and fifteen miles, and beyond rises to high dry lands and sand hills. The river channel averages about a half a mile in width, but is not filled with water the year around. In July and August the greater part of the channel becomes a bare expanse of shining and wind-shifting sand. In the spring months then, and during the early summer, the water must be used, when the river is higher and when the water level reaches above the head gates of the ditches.

To irrigate this valley of about sixty miles long and a few miles wide, in Scotts Bluffs county, Nebraska, bordering on eastern Wyoming, there are today at least seventeen ditches, varying in their lengths from five miles to twenty-five miles, and correspondingly in their widths from one hundred and fifty-six feet at the head gate of the farmers' canal to two feet or less at the lower end of any ditch where it runs out. The size of an irrigating ditch depends not so much upon the distance to which the water must be carried as to the amount of land it must supply with water, and consequently with the number and size of the laterals.

A lateral is a branching ditch, no matter whether it be large or small. They are always fed by what is known as a lateral gate or box which meas-

ures and gauges the flow of water. These boxes are chutes for the water to pass through so as not to tear away the embankment. They are equipped with a sliding gate, which is raised or lowered according to the amount of water needed, which is allowed in the contract, and according to the head of water on, or, in other words, according to the amount of water flowing in the ditch.

There are two systems of water measurement, namely, the "miner's

tled to four inches pressure or head of water—that is, the water should rise four inches above the lower edge of the sliding gate on the outside. If the water does not reach this height, the farmer is entitled to raise the gate enough to compensate, because the amount of water passing through a gate will vary considerably with the pressure behind.

The "second-foot" system, as the term signifies, provides for a cubic foot of water for every second of time.



Stacking Alfalfa.

inch" and the "second foot." In both cases these are the units of measure. The first is used in older irrigation districts, the second finds favor in newer regions. Under the "miner's inch," the usual quantity of water estimated as required for one acre during one year is that amount which will flow continuously for the season through an aperture of one square inch; of course, this varies with the nature of the soil and with the "lay" of the land. The farmer is also enti-

The water pressure must always be taken into consideration. Water appropriations in Nebraska for irrigation allot a second-foot of water for each seventy acres of land. These two systems vary more in their methods than in the final results.

Up to the present time, however, while there are rules and regulations for measuring the water and purchasing it, more or less liberty is allowed, as water has never been so scarce during the seasons when most needed that

it has been necessary to enforce rules very strictly, except in the later summer weeks each year, when the river falls and when the "ditch rider" must pro-rate the water among the buyers. In this case, if a man orders into his laterals on a certain day, say forty inches of water, which is measured by a lateral gate twenty inches wide, with a gate lifted two inches, and with a head of four inches, he does not get that amount, but perhaps only eight-

rate the water and at a time when he has the least amount available.

Ordinarily, under irrigation, the fields are given two good soakings as early as possible and one later on. This applies particularly to alfalfa. A field is flooded as carefully as possible, and consequently flat-lying land is much more easily handled, for, with small dykes and intersecting ditches, the water can be spread evenly. But on sloping land the low-lying places



A Wheat Crop of Fifty Bushels to the Acre

tenths, or thirty-two inches, in which case he must lower his gate to get his lawful share. Also, he cannot take it at any time he wishes, but he must consult the "ditch-rider," who allots to him his time for drawing off water. In this way, all are treated fairly, and this is the most difficult task for the "rider," because, in addition to riding along the full length of the ditch every day to examine it, he must figure out very clearly just how he must pro-

always get more than their share, and there is a tendency for the water to wash out the soil as it seeks the lower level. A ridge in a field is a farmer's problem and it gives him no end of trouble until he simply cuts it away.

In the North Platte valley, as in nearly all irrigation regions, there are two systems of irrigation—that is, as to the business organization. These are the corporation or company system and the district system. As this is

a non-partisan article, only an outline of the two systems is given, because it has been and is today one of the moving and important questions with which the irrigation community must deal.

The company system is typified by the organization of the Winter Creek Ditch Company. This ditch was begun in 1889 and finished about two years later. Those interested built the canal themselves, during the winter months mostly, and took out the value of their labor in stock in the company. There was a regular organization perfected with officers and directors. This organization remains today in spite of efforts made to change to the other system. The water is sold to the consumer at so much per year, averaging \$160 for each quarter section of land, or at \$1.00 per acre. Originally, when expenses were low and the company and land were new, the cost was twenty-five cents per acre. But with the increasing valuations and with the augmented cost of maintenance, the price of water has been raised gradually to the higher figure. Last year, for the first time, a dividend was declared on the stock, of 3 per cent. While the farmers have realized practically nothing on their stock holdings, they have experienced an increase in the value of their land from almost nothing to as high as \$200 per acre, which has more than paid them.

In short, the corporation system is built upon the same line as any other like business organization, and the affairs are conducted more nearly like any other business. The administration of finances is vested with the officers and board of directors, and a stockholders' meeting is called annually, at which time all stock is represented by actual holders or by proxies. In this system, a man buys land and with it the right to a stipulated quantity of water; but there is nothing to prevent the price from being raised beyond an unprofitable figure—to the farmer—if the stock becomes controlled by single interests. However, un-

der ordinary circumstances the stockholders have the final word.

Under the other system, we find an organization perfected upon the same lines as a school district. It is the district system. All of the land along the route of a contemplated ditch, or after construction, which can be watered from it, is by popular vote made a district, with the proper officers. The district organization is empowered by law to issue bonds for construction in the same way as a school district issues bonds to build a school house. Every land owner, then, in that district is assessed according to his acreage. The tax levy is made to cover ditch expenses, to purchase water, to cover payments on the district bonds, and to create a sinking fund to pay off the bonds as they mature. In an irrigation district each owner of forty acres has one vote, but no one person has more than one vote, no matter how large his land holdings.

The cost to the farmer under this system is practically the same as in the other. The superiority claimed is that the advantage of increased valuations are distributed more or less evenly to every land owner, whether he uses the water or not, for every acre has a share in the country's prosperity. It makes the man who holds land merely for speculation or who is waiting for simple value accretions without the application of real labor for improvements pay his share of the costs of development, as well as he who, laboriously, from year to year, brings his land into good condition. To sum up, the principal advantage claimed for this system is that every man pays his share of the cost of developing the country if he hopes to reap any benefit thereby. The system is designed to prevent speculation, and the water user is supposed to get water at a minimum cost. When the bonds issued for construction expense are paid, the land owners get free water, except that the district, of course, has to pay for maintenance and superintendence.

The kind of crops raised in the North Platte valley, as in other like places, is slowly but gradually changing. This is due to a considerable extent to the construction of a line of the Burlington Road through the valley within the past five years. There is also a tendency for irrigation farmers to retain rather a small acreage, and devote themselves to intensive rather than to extensive methods of cultiva-

such as alfalfa or wheat-grass hay, both of which yield well under irrigation. But irrigated land is too valuable to use other than in intensive agriculture.

Present estimates of crop returns show that on the average twenty-eight bushels of wheat are obtained to the acre, with the yield going as high as fifty bushels. This is a good hard wheat and makes excellent flour. Oats



A Typical Headgate on the North Platte.
There are nine gates, as shown by uprights.

tion as heretofore. Many a farmer who wishes to hold for himself only what he can personally care for will lease or rent out three-fourths of a quarter section, retaining perhaps forty acres to which he devotes his attention. Labor is scarce in such new districts and farmers are forced to do this, or allow part of their land to lie idle or keep it for grazing purposes, or perhaps raise crops which take little attention while yielding fair returns,

average thirty bushels to the acre and sometimes reach ninety bushels; this is a good, full, heavy grade of oats. Corn is not a good irrigation crop, or rather other crops pay better; very little of this cereal is raised.

Three cuttings of alfalfa are made every season, the first being the best. The average yield is five tons to the acre, but it may reach seven and eight tons. This is a valuable forage plant and is particularly good for growing

cattle; a ration of grain is necessary for fattening them. Alfalfa may be stacked in the summer and fall and late in the spring, and a year or more later the inner part of the stack will be almost as green and fresh as when cut. This is because of the dry atmosphere through the winter. On all hay the curing process can go on almost without interruption. The consequence is that there are few storage barns. The average price paid for al-

stock as a valuable forage plant, yields from one to two tons per acre. It requires practically no care and yields one cutting. During the past three years \$6.00 has been paid per ton. Some quantities have been shipped to breeders of fancy stock and horses in Massachusetts, Connecticut, and New York, where it brings high prices.

Today, potatoes are attracting the attention of irrigation farmers. The average yield during the past two



The Gering Ditch Reservoir in the "Bad Lands" at the Base of the Famed Scott's Bluff. View from an elevation of over 500 feet. North Platte River beyond.

falfa during the past three years has been \$3.50 per ton. Alfalfa is also a wonderful fertilizer and subsoiler. Its roots reach into the soil from ten to twenty feet, and when the sod of an alfalfa field is broken for planting grain crops the farmer expects rich returns, and seldom is disappointed.

What is known as wheat-grass hay, and which is becoming known the country over among feeders of fine

years has been one hundred and fifty bushels to the acre, and in some cases yielding as high as six hundred bushels. Previous to three years ago, potatoes brought between 30 and 40 cents as an average; now 80 and 90 cents is sometimes paid, with the average between 50 and 60 cents. It is found that the light soil is particularly adapted to the cultivation of very fine tubers. Farmers are now planting

seed potatoes obtained from the Red River country of the North, having learned that imported seed stock yields vastly greater results, and especially the Red River potato.

This is but an instance of the application of scientific methods in agriculture and shows what schools of agriculture and farmers institutes are doing for our country. An interesting sight is carloads of potatoes shipped out for the market and other carloads shipped in for planting, and all handled on the same day.

A little story is told of potato culture which also illustrates scientific methods. It is of a progressive farmer who proposed to plant potatoes on non-irrigable land, but who expected to provide moisture by planting onions along with them, so as to make the potatoes' eyes water. As to results we cannot vouch, but it is true that irrigated onions have proved a wonderful

success when the market offered reasonable prices.

In addition to this latter crop, irrigation yields vast returns in sugar-beet culture. A sugar-beet factory site is now surveyed and considerable land is owned by a wealthy company. Small fruits and vegetables are natural crops for irrigated land and already many acres of strawberries are under cultivation and will be yielding large returns within one or two years at the most.

Irrigation in this valley, set apart by itself, is practically in the same state of development as all other like irrigation regions—just at the beginning of great possibilities. It means that that vast region of what is commonly known as the "great arid West" is just waiting the application of American industry, brain, and brawn to transform it into wide reaches of beautiful farms and gardens, surrounding happy homes.

FORESTRY IN MARYLAND

BY

WILLIAM BULLOCK CLARK

State Geologist of Maryland.

MARYLAND has done little hitherto to protect her forest interests. By an early statute the malicious setting on fire of any woods is punishable by a fine in a few counties, but as no special provision is made to enforce it the law affords inadequate protection and can never completely control the evil. At the last session of the general assembly a general law was introduced, but received little support from the state's representatives. With the passage of progressive legislation elsewhere and the recognition on the part of many intelligent citizens that the state's forest wealth is being rapidly depleted, there is evidence at the present time of a more aroused public interest than in the past, and the day is not far off when Maryland will take

her place with the other states in placing adequate forest laws on her statute books. It is coming to be realized that not only should the remnants of our present forests be preserved, but intelligent treatment should be given to the large deforested areas that cannot in all probability be made available for any other purposes. An educational campaign is under way that is adding many recruits to the forestry movement.

While Maryland has been thus backward in passing adequate laws to conserve its forest wealth, systematic investigations of its forest conditions have been under way for the past six or seven years. In 1896 the state made provision for the establishment of a State Geological and Economic Sur-

vey, and early in its career this bureau arranged for a co-operative survey of the wooded areas of the several counties with the then Bureau of Forestry of the United States Department of Agriculture. The topographic survey of the state was already well advanced and the experts detailed by the national bureau platted the results of their

Investigations to date have been completed for Garrett, Allegany, Cecil, St. Mary's, Calvert, Worcester, Kent, and Harford counties—eight of the twenty-three counties of the state. Reports giving a detailed account of the forest conditions have already been issued by the Maryland Geological Survey for Garrett, Allegany, and Ce-



Barrens Timber; an area recently cut over.

field observations on the detailed maps at their disposal. This important work, which has been carried on at intervals since it was first inaugurated, has already resulted in the mapping of the wooded areas of several counties, and there is every assurance that the entire state will ultimately be mapped in this way.

cil counties, while the manuscripts relating to St. Mary's and Calvert counties are awaiting publication. A forest map of Worcester county showing the commercial types has already been printed, on the scale of one mile to the inch. The forest types are represented on the map in different colors and a convention is introduced showing



Neglected Farmland, Eastern Allegany County, Maryland.

whether the trees are "young," "poles" or "merchantable."

It is believed that this detailed in-

vestigation of the forest resources of the state will afford a basis for a more intelligent treatment of the forest re-



A Good Stand, Sassafras Neck.

sources than would otherwise have been possible. The information will be at hand for the establishment of state forest reserves whenever Maryland is ready to segregate through gift, or purchase tracts for this purpose. To the investor the data thus rendered available will be of the greatest service. Of chief importance, however, will be the information given in these publications to the land owner in every county as to the best treatment to be accorded to his wood lands.

These investigations, however, would possess incalculably greater value and produce effects far more lasting if the state would make provision for a forester who could be consulted at all times by the people of the state, and who, with the information furnished by the reports and maps, could instruct those desirous of introducing practical methods in the handling of

their woodlands, and especially in the reforestation of tracts but lately cut down. Proper protection against fire must also be secured by the designation of fire wardens for the several counties who in emergencies could secure helpers and who would necessarily be under the control of the state forester. When the amount of timber annually destroyed by fire equals in value that secured by the lumbering interests, it is high time that the same stringent laws should be passed in Maryland that have been found so efficient in other states. There is no question that Maryland could add enormously to her material resources in a comparatively few years by adopting those measures which the experience of other countries and in recent years the experience of many of our own states has shown to be so valuable in developing the forest wealth.

NATIONAL RECLAMATION*

BY

CHARLES D. WALCOTT

Director U. S. Geological Survey and the Reclamation Service.

THE propaganda for "National Irrigation" was pushed forward at all times, in season and out of season, by John Wesley Powell. From 1874 to 1892 it was always in his mind, and no amount of discouragement or defeat could convince him that it was not a wise thing for the nation, and that a full measure of success would come in due time. He lived to see the present reclamation act placed on the statute book and the great work begun.

Many men were associated with Major Powell in the pioneer days, but in the dark days of 1892 few spoke out so as to be heard. Irrigation was in disfavor at the Capital. Slowly the reaction came.

The National Irrigation Association brought together the friends of irrigation, and when organized by its effective and accomplished executive chairman, it became a power that produced results.

The propaganda among the people of the Middle and Eastern States began to bear fruit, and soon the senators and members from the Western States, who were making a great fight, began to feel that support was coming from unexpected quarters.

At this juncture a new and powerful force was added to the movement by the succession of Theodore Roosevelt to the presidency.

An earnest, ardent advocate, with knowledge of the subject from his life

*Paper read at the Thirteenth National Irrigation Congress, at Portland, Oregon.

in the West, he encouraged all workers and spurred them on to renewed efforts, and June 17, 1902, he signed the Reclamation Act, and thus closed the long contest for recognition and national aid in the irrigation of the lands of the arid and semi-arid states and territories.

EXECUTION OF THE LAW.

The time for propaganda and argument passed when the President signed the act. It was now the time to carry the law into effect. Under its provisions the Secretary of the Interior had charge of the execution of the law.

After consultation with the President, the Secretary placed the administration of the Reclamation Service under the United States Geological Survey, subject to the approval by him of plans of operations and of all contracts.

The Survey, through its Division of Hydrography, had been training a body of men for the work now assigned to it.

In 1894 Mr. F. H. Newell was appointed chief of a very small force, and began the organization of a body of hydrographers and engineers, which increased from year to year as the quality of its work commended it to the people and to Congress.

With this nucleus for a larger organization it was logical that the President and Secretary of the Interior should turn to it in initiating the greater work. The country was most fortunate in having at this critical period a President who fully comprehended and was in sympathy with the needs of the people of the western section of the country, where irrigation is necessary, and a Secretary of the Interior whose integrity and good business sense insured a conservative and business-like administration of the Reclamation Service.

No time was lost in getting the engineers at work and in developing the administrative organization so as to meet the constantly increasing demands upon it. The experience of the

officers of the Survey in all departments was called into service, and both office and field work advanced without confusion.

ORGANIZATION AND DEVELOPMENT OF THE WORK.

During the past three years the difficult organization of a body of men, whose field of operations cover so large a territory, has been perfected, and precedents established along approved lines.

The general allotment of funds has been made with a view to the greatest benefit to the greatest number, and from the broad standpoint of the welfare of the country as a whole.

Construction is now in progress on eleven projects. These primary projects, or the first undertaken for construction in each state and territory, have been and are being selected in accordance with present knowledge to include conditions most favorable for rapid work and where there are least difficulties.

First consideration is given to whether public lands can be reclaimed and homes made on them, and where communities are threatened with extinction unless aid is given them by increasing their water supply. As each primary project is outlined, funds are tentatively set aside for construction, contingent upon obtaining right of way and the solution of various difficulties.

A list of the primary projects, showing the estimated cost and the acreage irrigable, is given below, divided into two tables, showing those under construction and those approved but where the final surveys and designs are not far enough along for the letting of contracts.

PROJECTS UNDER CONSTRUCTION.

State.	Project.	Acrea Irrigable.
1. Arizona	Salt River	160,000
2. California	Yuma	100,000
3. Colorado	Uncompagire Valley	125,000
4. Idaho	Minidoka	100,000
5. Montana	Huntley	35,000
6. Nebraska	North Platte	100,000
7. Nevada	Truckee-Carson	150,000

8. New Mexico	Hondo	10,000
9. North Dakota	Fort Buford	60,000
10. South Dakota	Belle Fourche	85,000
11. Wyoming	Shoshone	125,000
		<hr/>
		1,050,000

In addition to the above, the following projects have been approved:

State.	Project.	Acres Irrigable.
1. Oregon	Klamath	236,400
2. Montana	Milk River	60,000
3. North Dakota	*Buford Trenton	18,000
4. North Dakota	*Bismark	15,000
5. Washington	Okanogan	10,000
		<hr/>
		239,400

*Pumping.

Thus far, as shown above, projects have been approved for thirteen out of sixteen states and territories mentioned by the reclamation law, and construction is under way in eleven of them.

In several other states operations are at a point where advertisements for bids only await the removal of certain legal obstacles, the settlement of international difficulties, or the termination of delays on the part of local organizations or individuals.

SECONDARY PROJECTS.

In most of the states examinations have been made of all possible projects, and after one of these has been selected as the primary project for immediate construction, surveys have been continued of the secondary project, to be taken up on the completion of the first, or earlier, if for any cause the first project fails through any defect.

It is important to obtain systematically full facts concerning the water supply through several years, to make borings for foundations, and to prepare plans and discuss them thoroughly, so that the secondary projects can be taken up in the future with more complete knowledge than was possible in the first projects.

The Reclamation Service is constantly being importuned to make surveys in all parts of the country and expend the money broadly. The time has arrived, however, when it is nec-

essary to limit general surveys, as there is not money in the fund to construct more than one or two projects in each state or territory, and general surveys will lead to expenditure without present adequate return.

DEVELOPMENT OF POWER.

One of the important features in the evolution of irrigation work is the development of power, which the numerous dams and drops in canals make possible.

Plans were made to transmit the power being developed in many sections of arid regions, by means of electricity, to points more or less distant, there to be used for raising underground waters, pumping water lying above the line of gravity canals, or for various other purposes, and attention was also given to the character of soils and of water to be used upon them, the materials used in the construction of the works, and numerous other details incident to reclamation by irrigation.

FINANCES.

In a work of the magnitude of that authorized by the Reclamation act, it is highly important to forecast the future in so far as past experience can aid in doing so, and to estimate as closely as possible the probable resources and liabilities that may be anticipated. A summary of the receipts from the sales of public lands in the reclamation states and territories for the ten years preceding the passage of the act shows that the maximum amount which would have been covered into the reclamation fund in any one year, had the act been in force, was \$3,185,000, and the minimum \$1,085,000, the average being \$2,095,000.

Following the passage of the act of June 17, 1902, there was a great rush to take up land and a corresponding increase in the annual amounts available for the work of reclamation, but this condition cannot be expected to continue. The estimate for the future, as given in the last quarterly state-

ment, was that the receipts during the fiscal years of 1905 and 1906 would together equal those of 1904, \$6,826,000, and that the increment thereafter would average \$2,000,000 annually. Should this estimate be verified by the experience of the next three years, the entire receipts to the fund on June 30, 1907, will be \$32,200,000.

It is important to emphasize this statement because there is a natural tendency to overestimate the resources available and to urge the taking up of additional work beyond the amount which conservative judgment will warrant. This is especially to be considered, too, because in the authorization of a project the letting of the earlier contracts does not indicate the total liability incurred, since other contracts must be entered into as the work progresses to a point where it is practicable to take up further details of the construction of the project.

REPAYMENTS.

The reclamation law provides that all cost of each project shall be returned to the reclamation fund by the settler in ten annual payments without interest. These will necessarily be small until 1907. After that a gradually increasing sum should be returned, and by 1910 two million or more dollars per annum should become available for new projects.

The annual payments may, at the discretion of the Secretary of the Interior, be not of equal amount, but may be graduated, so that the first payment, when the settler is least able to pay, is a smaller amount than later on.

PRESENT AND FUTURE.

The physical and financial situation has already been outlined. In Nevada water is flowing on lands from a government canal. This brings us face to face with the question of settlement under government reclamation projects. The primary idea of the reclamation propaganda and law is the making of homes for American citizens. Speculative intent is guarded

against, also the demoralizing effects of gifts by the government to the individual. The government has done all that could be reasonably expected of it in providing land and water at cost. Each settler and community under a reclamation project is placed on an equal footing by the reclamation law—all have the same chance. Now the individual and the community have a duty to perform to the government; they must carry out in good faith all agreements for payment of principal and cost of maintenance. Any attempt at evasion or repudiation will arouse a sentiment throughout the nation that would be fatal to any greater development of the reclamation work in the future. I mention this, as suggestion has been made that the people will get relief from payments in the future. I trust that the good sense and business integrity of the western people will be so manifest, if any such proposals are made, that it will not be attempted a second time.

Much depends upon the success of the first few projects. The people of the whole country are interested and watching. The sentiment is pretty well squeezed out of the situation; it is a business proposition and as such must be worked out on business lines. The works must be well planned and built; estimates not greatly exceeded in cost of construction and maintenance; settlements of a good and permanent character that will meet all obligations and take full advantage of all opportunities for intensive cultivation of lands. If these conditions are met, the people of the country will say *well done*, and undoubtedly enlarge the work as rapidly as the opportunities for reclaiming lands and making homes are determined and recommended by the Reclamation Service.

Among the principles thus far developed that may aid in shaping the policy of the future, four may be mentioned here:

(a) The money resulting from the disposal of public lands belongs to the nation and not to any community.

When placed to the credit of the reclamation fund it will be used to provide the greatest number of favorable opportunities for home-makers, subject to the restrictions of the reclamation law.

(b) Each project undertaken must justify itself as an engineering and business proposition, and come within the requirements of the reclamation law.

(c) The funds available and to become available in the next few years will be too limited to provide for more than a portion of the projects that will ultimately be developed. The projects

now under construction should be completed and justify themselves to the great jury of the American people before they are asked to give further aid to the reclamation of the arid and semi-arid lands of the West.

(d) The lands in private ownership which may be reclaimed must be subdivided and put into the hands of home-makers who will cultivate the soil in small tracts of 160 acres or less. Large land holdings must be subdivided or an agreement entered into to subdivide the tracts when water is available, in accordance with the terms of the Reclamation Act.

THE IMPORTANCE OF THE WHITE MOUNTAINS AND OTHER FOREST RESERVES FROM THE TEACHER'S STANDPOINT

BY

F. WILLIAM RANE

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WE shall take pride in our nation as a people in the future in proportion to our well-done deeds and accomplishments of the present day. We shall never have it to regret if at the coming Congress a law is enacted to set aside the proposed White Mountain Forest Reserve.

We of the old Granite State have already shown our interest to be unselfish by voting money for the preliminary survey, thereby placing the matter before the country as a business privilege.

This proposed White Mountain Reserve is beautiful almost beyond description. This scenic bit of country belongs to the nation, although it is located within the bounds of New Hampshire, as truly as though we had it enclosed in a beautiful glass case and on exhibition in one of the government buildings at Washington. Not only is

this rare tract of our nation's pride beautiful, but our forest experts clearly demonstrate that by proper handling this territory cannot only always be kept thus, but be made self-sustaining and ultimately yield an actual income to the government. The whole question resolves itself down to whether it is more economical for us to acquire the property now, when it can be retained in its more or less normal condition, or wait until these conditions are far less desirable. The old adage that "a stitch in time saves nine" has its application in national affairs as well as in other and lesser walks of life. Were New Hampshire, which happens to be a small state, entertaining the nation at her own expense, she would likely find it burdensome, and be compelled to charge an admittance to meet expenses. Not having any restrictions, however, every other state

or citizen has equal privileges with her own.

Some persons seem to think that congressmen are prone to look at such questions only from the standpoint of sectional interests. The time has come when as Americans it is believed sectionalism is rapidly disappearing. We of New Hampshire can see the claims put forth by those interested in the proposed Southern Appalachian Reserve as readily as we do our own, and the agitation of the White Mountain proposition does not lessen, but emphasizes the importance of each.

Conditions have only come about in very recent years whereby Congress could feel justified in setting aside such vast tracts and feel assured that they would be handled judiciously. In a comparatively few years the whole matter pertaining to a systematic national forestry policy has been unfolded to us. With the rapidly extending and wisely guided corps of workers in the field that the nation is already so proud of, we can rest assured that governmental supervision, whereby conservative and economic methods will be carried out, is at hand.

The writer does not care to go into the discussion of other vital and all-important subjects that further go to emphasize the great importance of setting aside this area of our country. Students having given any attention to such subjects as the comparative evolution of nations, laying any stress whatsoever upon the results coming from efforts directed toward forest preservation and management, readily see corresponding results in individual nations' internal power and usefulness. It is not the duty nor is it possible for the individual or state to accomplish the broad and widespread usefulness that becomes the privilege of the nation to enjoy in solving these larger problems of the nation's future.

The writer, as the instructor of young men, who will ultimately become our land owners and agricultural leaders, finds his present duties utilized

largely in demonstrating the practical solution of handling lands for definite purposes. Every state is interested in training its own citizens for their life work and hence developing men worthy of handling future problems. The majority of us in this educational work believe much good must ultimately come from this work, but we can do but little in furthering such a worthy problem as needs national solution at the hands of Congress. That every professor of forestry in the various states is doing what he can, however, to promote the interest and emphasize the importance of forestry throughout the nation, there can be no doubt. When I say, therefore, that the White Mountain Forest Reserve movement is backed by these men I feel sure of my claim. What is said for the White Mountain Reserve may be said equally for the Southern Appalachian Reserve.

We in New England believe fully that we take more pride and enjoyment when privileged to visit and enjoy the benefits to be derived from a visit to the Yellowstone National Park than our own citizens living in the West, and similarly do we find other people from other sections enjoying our beautiful White Hills of old New England.

We need to preserve the watersheds of New England for irrigating our valley lands and to give us an equitable water flow for our industries as much as do our western people to supply their great artificial irrigation systems. The government would not allow the forests removed after it had gone to great expense in building irrigation enterprises which depend upon such reservoirs for success; none the less should the White Mountain and other proposed reserves be allowed to succumb to injudicious management. While the conduits or streams are natural and have not been an actual outlay of expense to the government,

nevertheless the importance of their judicious husbanding by the nation is equally as great.

If the national government will look after the great watersheds and natural reservoirs of the country, the states will gladly improve and enhance their

forest policies and resources. If, however, the larger and more important conditions that are necessary for best success are left uncared for the harder and less successful will be the efforts to maintain and develop what are really dependent conditions.

APPORTIONMENT OF THE RECLAMATION FUND

BY

H. M. SUTER

THE apportionment of the Reclamation Fund is naturally a matter of great moment to the several Western States and Territories within whose borders national works of irrigation are projected.

Recent comments and criticisms in leading western papers concerning this subject indicate that a misapprehension exists in the minds of the writers especially in regard to the interpretation given to the act of the Secretary of the Interior in setting aside certain money for a project. It is not to be inferred that by "setting aside" or apportioning money, it is actually taken out of the treasury or put by itself. On the contrary, the amount is simply entered upon the books as the proposed limit of future expenditures. The difference between this apportionment and making an actual contract to pay money has often been misunderstood. They are entirely distinct. To illustrate: When the surveys are completed and the feasibility of a

project ascertained a concise report is made to the Secretary with the recommendation that the scheme be approved and the amount required in construction be set aside contingent upon the fulfilment of certain conditions which usually relate to vested rights and the co-operation of owners of lands under the project.

In making this allotment the Secretary has incurred no legal or moral responsibility. If, however, a contract is let for an integral part of the work, the Secretary then assumes a legal responsibility for that part only. He must be absolutely certain that there is sufficiently money in the treasury to complete this contract even though final payments may not be required for several years. At the present time actual construction is in progress on portions of eleven great projects requiring about three years for their completion. The estimated cost of all parts of these projects is about equal to the total amount now in the Reclamation Fund.



THE PRODUCTION OF OIL OF WINTERGREEN

BY

HAROLD DAY FOSTER

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THE "oil of wintergreen" of commerce is the product of the distillation of an etherial oil. It was formerly obtained from the leaves of the wintergreen or checkerberry (*Gaultheria procumbens*, Linn.). But the production of the oil from this species has been largely discontinued owing to the great cost of gathering the plant in sufficient amounts. Almost all of the "natural oil" now on the market is obtained from the sweet birch (*Betula lenta*, Linn.).

This tree has a wide botanical distribution in the eastern United States, but it is in the southern Apalachian Mountains that it occurs at its best. Here it is found as a timber tree of some importance and is lumbered for its wood which is used in the manufacture of furniture. The bark alone is utilized in distilling the oil, and in some regions where the tree does not attain to sufficient size to make good saw stock, or for local reasons there is not a satisfactory market for the lumber, the bark is peeled from the felled trees which are then discarded. The following notes on the distillation of birch oil apply to the industry as it was observed in McDowell county, North Carolina:

In this region the hardwood forests are being lumbered and the merchantable trees of the many species which occur here are being taken out. Some birch lumber is sold to the furniture trade, but as a rule birch is a poor seller and only a few trees in this section are large enough to make good lumber. Distillation of the oil is carried on by local residents. The lumber company charges the distillers 20 cents for every tree cut, deducting this

amount from the proceeds of the sale of the crude oil.

After felling the trees they are peeled while green. It is essential that the bark be green, for if it is allowed to dry out before being used it becomes worthless for distilling purposes owing to the rapid evaporation of the etherial oil. The bark is stripped from the trunk and stump and the larger limbs, but the twigs and the bark of the smaller branches are not used. (See illustration No. I.) The bark is brought to the distillery and put on the floor around which there is a narrow strip of lumber forming a shallow box. Here it is chipped up fine with axes. Everything about the distillery and the methods of distilling are simple to the point of crudeness.

The distillery most commonly consists of a floor on which the bark is chipped, and one or more vats or stills with their condensers, and these are roofed over with a rude framework of poles covered with hemlock bark. This shed serves to protect the birch bark from the drying sun, and the fires from rain, as well as shielding the workers from the weather (See illustration No. II.)

The stills are 3 feet wide by 4 feet long and 3 feet deep. They are constructed of wood with cast iron bottoms and steam-tight tops or covers. The still is placed in position on two parallel rows of flat rocks one under each side of the box, leaving a space underneath on which fire is placed. The smoke escapes through a vent or low chimney of flat rock at the rear.

Inside the box and about 4 inches above the iron bottom is a grating of

wooden strips 4 inches wide and placed about one inch apart. Under this grating water is boiled by a fire placed on the ground under the iron bottom, and the chipped bark rests on the grating. The grating thus keeps the bark out of the water and the steam alone, as it rises through the still filled with bark, extracts the oil.

After filling the still with finely chipped bark the top is placed on and

iron water pipe. In some cases it is bent to form a connection with the side of the vat; in other cases a wooden plug is wedged into the opening of the vat, through which an auger hole is bored, taking a right angle turn in the center of the block of wood. In the other side of the plug, at right angles to the side against the vat, the straight pipe is inserted, thus obviating the necessity of bending the pipe and



Fig. 1. Black Birch Tree Peeled for Oil.

held firmly in position by sticks and wedges. The steam rising through the grating and permeating the bark extracts and vaporizes the oil and carries it to the top and through an iron pipe or worm. This "worm," however, is not coiled as in the condensers of liquor stills, but is a simple straight

plugging the opening in the vat around the pipe.

The iron pipe is laid in a trough through which the water from a brook is deflected. The steam and vaporized oil passing in mixture into the worm is condensed there and the resulting water and oil trickles by drops into a

glass jar placed under the end of the pipe. Over the mouth of the jar is stretched a piece of cloth through which the oil and water are strained.

The oil sinks to the bottom of the jar as a dark red aromatic oil, and the smoky water from the worm remains on top, being lighter. As the jar overflows the water passes by a trough to the boiler in the bottom of the still where it is boiled over again. In this way, besides keeping the boiler filled automatically, there is the additional advantage that any unsepa-

should be kept boiling continuously. This is never done, however, at least in the region studied.

The oil is sold by the distillers at local drug stores. It is sold by the pound Troy weight, 13 fluid ounces to the pound. These stores sell it in New York and other eastern markets 12 ounces to the pound. The stores claim that they are obliged to buy it at 13 ounces to the pound on account of its averaging 1 ounce of water and other foreign matter per pound, which they have to remove.



Fig. II. The Condenser of a Birch Still.

rated oil which has failed to precipitate in the jar returns to the still to be again vaporized and condensed. (See illustration No. III.)

When the jar is about half full of oil—an amount which is equivalent to about one and one-half pounds of crude oil—all the oil is extracted. The bark is then shoveled out and discarded and the still refilled. About twenty-four hours of boiling is required to extract all the oil, and to get the best results it is said the water

The price of crude oil changes with the market. It is sometimes as low as \$1.25 a pound and again the price will run as high as \$3.00 per pound. The storekeepers in the local towns ship it in 3-gallon cans in its crude form to the chemists in New York and other eastern cities, selling it at an advance of about 25 to 30 per cent. more than they paid for it.

The wholesale chemists refine it and sell it as "essential oil of wintergreen." This is the "natural oil." "Artificial

oil" is made by a purely synthetic process in the laboratories. Chemically, it is exactly the same, and being produced at less expense sells at a much lower price. The price of the natural oil, as quoted by a wholesale chemist, April, 1905, was \$2.50 per pound, while the artificial oil was quoted at 75 cents. These were prices on oil sold in small amounts. In 25-pound cans the price was \$1.85 for the natural oil, and the artificial oil sold for

tainable from a single tree, but since a vat-full, equivalent to 36 cubic feet, yields one and one-half pounds of oil, and an average tree yields about one pound, it is safe to say that the bark from the average tree will fill the still two-thirds full, equivalent to 24 cubic feet of chipped bark which yields 1 pound of oil.

Deducting 20 cents, the price paid per tree to the owner of the timber, from the price realized on the oil it



Fig. III. A Mountain Birch Distillery.

50 cents in 5-pound bottles, or 42 cents in 50-pound cans. Larger quantities were sold at correspondingly lower figures.

I was told that a birch tree 12 inches in diameter yields \$2.25 worth of crude oil. Taking this as the average price per pound of 13 fluid ounces, and considering 12 inches as the average size of the trees felled for the purpose, the average tree will yield one pound of oil. I was unable to get a statement as to the amount of chipped bark ob-

will produce, or say \$2.20, the profit to the producer of the crude oil is \$2 per tree or per pound of 13 ounces. When it is considered that two-thirds of 24 hours, or 16 hours are spent in distilling one pound of oil, besides the labor and time involved in felling the tree, chipping the bark, and feeding the fire, the actual returns are not great. When two or more stills are in operation at the same distillery, as is usually the case, the question of time involved is not of as great weight

since it takes no more time to distill three pounds of oil from three stills than it does one pound from one still, but the larger distillery entails a greater labor to chip a larger amount of

bark and to keep the vats full and the fires fed. Usually, however, the labor in the process involved is not considered by the distiller from its economic standpoint.

SPRUCE FORESTS OF THE WHITE MOUNTAIN REGION

BY

AUSTIN CARY

THE White Mountains of New Hampshire contained in their native condition some of the finest spruce timber in New England, as heavy a stand perhaps as stood on any like area within the whole region of distribution of the species. These were not among the first New England forests to be cut through. The ground they stood on was so steep and rough and the streams which drained it, many of them, so ill adapted to log driving that it was not till the advent of railroads that the timber in these forests, thick and fine as it was, could be logged at a profit.

Meanwhile there arose in the Northeast and gathered in part about these woods, because they furnished the raw material, the pulp and paper business. The rapid development of this industry injected great values into the forests tributary to it. It had further this peculiarity as against the saw-mill business which claimed the more accessible and better watered forests of the Northeast, that a tree of very small size was merchantable. The logs which come to an eastern pulp mill would look very queer to lumbermen in most other parts of the country. Trees 8 inches in diameter at the stump as a rule are worth nearly as much per M standing as larger timber, and the cutting limit in this region for spruce and fir frequently is and has been even somewhat smaller.

Thus we have a striking contrast between cut and uncut lands in the region, a contrast which holds in every relation in which they can be conceived of. It holds in respect to value in the first place. Well timbered spruce land may be worth, to cut at once, anywhere from \$20 to \$100 per acre, while the cut-over land is hardly worth paying taxes on. Then it holds good in every protective relation. The virgin lands have a fine thick stock of trees which clothes the ground fully, keeps the soil moist, and is safe from wind throw. Spruce lands that have been newly cut, on the other hand, are an almost continuous brush heap. If scattering trees are left, either soft or hardwood, they frequently blow down. The country is very inflammable; reproduction is put at every disadvantage. Of course not all of the country is left as badly off as that. Easy valleys and ridges where there is a large proportion of hardwood, the severest kind of logging cannot deprive entirely of their cover. What is left, however, may be of little or no commercial value and an actual impediment as regards useful reproduction.

The effect of these conditions outside the White Mountain region is a difficult matter and will not be dealt with by the present writer. Within the White Mountain forests it would seem as if there could be no disagreement as regards either the conditions

or their effects. These, it will be well to review and deal with a little more fully.

First. No erosion of great amount need be feared here. Deep cutting the granite rocks of New Hampshire may be counted on to resist. The wash also of the surface soil and its vegetable cover is believed to be confined to very small districts.

Second. There is generally a liberal reproduction of one thing or another on the cut-over lands, no matter how they were cut. Nature provides this in spite of us, and we have only to protect it. As a rule, too, the new growth is of good type. Where spruce and fir stood before, fir and spruce come up again. There is more bush growth and worthless stuff amongst the regrowth in stands of soft and hardwoods.

Third. From the steep mountain slopes left in the shape they are by lumbering, the snows of winter melt very rapidly, and run into the streams much earlier in spring than they did when those slopes were timbered. The run-off of rain is not so easy to follow, but in respects to this there can be far less difference between cut and uncut land. Whatever these changes may amount to in their effects outside, it fair to say that conditions within the mountains are such that it would seem we must have got their full force already on every primary drainage except that of the Merrimac river.

Fourth. Fire, where it occurs, emphasizes all the bad conditions brought about by cutting, and does on its own account fresh and irreparable damage. It destroys advance growth that was on the ground already, and by burning up seed trees accidentally left destroys the means of fresh reproduction as well. Its destruction of soil, too, is oftentimes complete. The loss of the soil cover of rotten leaves, moss and roots is a detriment to any forest, but in large parts of the White Mountain district it means the whole thing. Fire on cut-over land, as a rule, postpones for some decades the re-establishment

of a productive forest and of forest conditions. In some places it destroys the possibility of forest growth for centuries. The first requisite for the maintenance of woods here whether valued for their productive or protective capacity, is effective fire protection.

The question now arises whether any other than a governmental agency can be looked to to do the right thing in the way of protection and management for these woods. Are not the industrial forces there such that they will themselves work out the problem in time? Can educational agencies be brought to bear or co-operation planned between owners and the state which will secure to the woods the treatment they deserve and require? Paper mill companies, for instance, in some instances and situations have handled their woods carefully and conservatively, as well probably as in the general interests of the public need be asked. Is their complete dominance in the White Mountains likely, and if it is, can it be looked to to secure, even after the lapse of time, the steady care and foresighted treatment which the woods require?

This is a matter of judgment, and different men might look at it differently. In the opinion of the writer there is no sufficient relief to be looked for in that direction. The reasons for this lie far back in the topography of the region, the forest conditions and the stand of timber. These mountains, as a rule, can't be handled as selection forests. Operation is too expensive and the risk to thinned woods from fire and wind too great. Clean cutting for a private owner is the only possible policy to pursue, and when that has taken place the value of the land is too small and the prospect of the future crop too distant to induce an individual or a corporation to provide the adequate protection. Public protection the case absolutely demands, and public ownership also is required if we are to secure for that policy either its utmost efficiency or

its just reward. The aesthetics of the situation and equalization of water-flow left entirely out of account, the future contribution of the White Mountain region to mere commercial prosperity, its permanent yield to manufacturing industries based on timber, seem to be bound up in public ownership and control.

And the fact that hampers and limits use in one direction is in another the very door of opportunity. That is the low value of the cut-over lands. There are considerable areas in the White Mountains that are worth nothing

whatever to their owners. They will hardly pay taxes on them. If they protect from fire in any degree, it is simply for the sake of neighboring timber. With an organization there which is capable of meeting business men with their own tactics and on their own ground, large areas of land can be acquired at very moderate expense. One thing that is necessary for such an organization to have, is authority when they condemn or purchase lands to allow to the owners under whatever restrictions are thought reasonable, the removal of the merchantable timber.

FORESTRY IN MARYLAND*

BY

W. D. STERRETT

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I. GENERAL FOREST CONDITIONS.

The total area of woodland in Maryland comprises about two and one-half million acres, constituting, approximately, 40 per cent of the total land area of the state; something less than 1 per cent of the wooded area is virgin forest. The forests of the state are mostly second growth and under 150 years in age. In the western part of the state there is much recently culled and cut-over virgin forest, with little second growth as yet, or covered with a very small brush growth under 25 feet in height.

The general forest conditions which prevail in Maryland can best be described separately for each of the three physiographic divisions which compose the area of the state: (1) The Appalachian Region, (2) the Piedmont Plateau, and (3) the Atlantic Coastal Plain.

1. *The Appalachian Region.* This composes about 20 per cent of the land area of the state and includes the

two most western counties and half of a third adjoining county. This is the most heavily wooded region of the state, and the lumber industry is here of first importance. The region supplies much lumber for the general market, besides the large quantity consumed locally in mines, pulp mills, and for building purposes. About 60 per cent of the area of this division, or some 750,000 acres, is woodland.

The elevation of this region is 500 to 3,400 feet above sea, forming a mountainous country of deep valleys and high ridges. The upper slopes and ridges are unsuited for agriculture, and it is not probable that to any extent additional areas of forest will be cleared for farming purposes, as the best lands are already cleared, and many areas once cultivated are being abandoned on account of their poor soil.

The forests of this region consist mostly of recently culled and cut-over virgin forest, and there has not suf-

*This article is based upon data secured through the co-operative forest work carried on by the Maryland Geological Survey and the U. S. Forest Service, and is printed here with their permission.

ficient time elapsed for second growth of any size to develop. What little virgin forest there is in Maryland is located in inaccessible parts of this region. "The prevailing growth is deciduous, but this is conspicuously mingled with patches and often large areas of conifers.*" "The peculiar position of western Maryland, intermediate between North and South, gives the region a forest flora rich in species,"* there being in all upward of seventy distinct tree species. "Conifers and hardwoods of the middle

system of lumbering which has lately been inaugurated in the region. Trees of nearly all species down to very small sizes are used for mine props and lagging. The prevailing forest condition is that of cut-over virgin forest covered with a scattering growth of large defective trees not suitable for lumber, interspersed with reproduction of hardwood sprouts and seedlings and occasional patches of coniferous reproduction. The prevalence of fires following the severe lumbering has greatly deteriorated the



Photo by U. S. Forest Service.

Typical Willow Bottomland; Howard County, Maryland.

south and north mingle here almost on the same ground."* The important timber trees occurring in the region include the conifers white pine, hemlock, spruce, pitch, and short-leaf pines, and the hardwoods red, white, and chestnut oaks, chestnut, tulip, poplar, basswood, birch, beech, and maple.

Nearly all the merchantable coniferous trees have already been culled from the forests of this region, and the hardwoods are now rapidly being cleaned out under the highly intensive

quality of the reproduction and second growth, so that the outlook for a valuable future crop is at present not bright.

2. *The Piedmont Plateau.* This comprises about 30 per cent of the land area of the state. It is a fertile region of rolling hills, with a general variation in altitude of 100 to 500 feet above sea, and extends from the Appalachian Region to Chesapeake Bay. It is the most lightly wooded part of Maryland, and the lumber industry is

*Allegany County Report.

ere of very slight importance. It is estimated that about 25 per cent of the region is woodland, or some 700,000 acres.

There are no large timber tracts in this region, and the forest area is almost exclusively made up of farmer's woodlots or small tracts, for the most part under 100 acres in area. The for-

pared with the heavily culled and burned over forests of the Appalachian Region. As the forest areas are usually small and much broken up by fields, pastures, and roads, extensive forest fires do not occur. However, all the woodlots now produce much less timber than they are capable of producing if properly managed. The



Photo by U. S. Forest Service.

Loblolly Pine Poles; Worcester County, Maryland.

est is second-growth hardwoods, with oak, chestnut, hickory, tulip poplar, and maple the prevailing trees. It is mostly of sprout origin, under one hundred years in age. There is also some old field growth scrub pine in this region. These wood-lot forests are in fairly good condition, as com-

forest is usually understocked, due to frequent random culling out of timber as needed, instead of systematic cutting.

3. *The Coastal Plain.* About one-half of the area of Maryland is comprised in this physiographic division. The elevation of this half of Mary-

land is less than 100 feet above sea and is for the most part under 50 feet. This region is fairly heavily wooded and the lumber industry is here of considerable importance, but almost exclusively in the manufacture of lumber for local consumption. It is estimated that 40 per cent of the region is wooded, or over one million acres

The forests of this region occur in much larger bodies than in the Piedmont Plateau, but there are no such immense continuous tracts as found in the Appalachian Region. The lumbering here is characterized by an abundance of small saw mills—many portable—in contradistinction from the lumbering in the Appalachian Re-



Barrens Timber; a Thin Stand, Due to Fire.

practically, all of which is second growth under 150 years in age. Before the civil war a much larger per cent was cleared and worked as farm land than at present, but since that time much of it has been abandoned and has grown up, for the most part to a thick growth of scrub or loblolly pine.

gion, which is carried on mostly by a few large operators. The lumbering is mostly of second-growth yellow pine 40 to 100 years old which has not had time to attain the large dimensions of virgin timber.

The forests of this region are over half yellow pine, which occurs sometimes in mixture with hardwoods, but

more frequently pure. The species of yellow pine which occur, in order of their importance, are loblolly, scrub, short-leaf, and pitch. The pine on land over forty feet in elevation above sea is prevailingly scrub, and below forty feet is mostly loblolly.

In the United States census for 1900 the following figures are given on the lumber industry in Maryland for that year:

Cut of conifers...109,651,000 board ft.
Hardwoods..... 78,306,000 board ft.

Total.....187,957,000 board ft.
Value of product.....\$2,650,082

by the United States Forest Service and personal advice and assistance given by this bureau to private owners in handling their wood lands; (2) the co-operation of the Maryland State Geological Survey with the United States Forest Service in the investigation and mapping of the forests of the state by counties, including practicable recommendations in regard to forest management by private owners.

Interest in forestry by private owners of woodlands in Maryland may be said to date from October, 1898; so that the forestry movement in the



Photo by U. S. Forest Service.

A Loblolly Pine Forest.

Probably about half of this lumber produced was from the mountain region and half from the Coastal Plain, but none to speak of from the Piedmont section.

II. PROGRESS OF FORESTRY IN THE STATE.

The developments of forestry in Maryland has progressed steadily along educational and practical lines. The actual practice of forestry in the state has been entirely by private land owners, as there are as yet no state or federal forest reserves in Maryland. The impulse for private forestry has come chiefly from two sources: (1) The diffusion of literature on forestry

state is as yet little more than seven years old. It was in the fall of 1898 that the Forest Service (at that time the Division of Forestry) issued Circular 21 offering personal advice and assistance to private owners in the management of woodlands. Previous to this the work of the Forest Service had been purely of an educational nature in the diffusion of literature on forestry, and little or nothing in the way of practical private forestry had been accomplished. This offer of personal inspection of wood lands by an expert, followed by practical advice and assistance in handling the forest, gave the initial impetus to private forestry. Many private owners of wood

lots in the Piedmont Plateau have availed themselves of the offer of the Forest Service and have had their woodlands examined, and are in consequence carrying out a policy of rational forest management. Little interest as yet, however, has been displayed by the large timberland owners of the Appalachian Region, and no forest working plans have been prepared in this section. Intensive lumbering, prevalence of fires, and slowness of tree growth in this region are

portant one. The work was commenced early in the year 1900, when necessary forest experts were furnished and their salaries paid by the Forest Service, while all traveling and living expenses of the field party were defrayed by the state Geological Sur-
sinee, and up to the present date the forests of nine out of the twenty-three counties in Maryland have been examined and the wood lands carefully mapped. Reports on three of the counties have been published by the



Cut and Culled Forest Hemlock Lands, Castleman River, Garrett County, Maryland.

great hindrances to the adoption of private forestry. Some forestry work has been done on small tracts in the Coastal Plain, but not as much as in the Piedmont Region. Forest conditions in this section are especially bright for private forest management.

The co-operation between the Forest Service and the Maryland Geological Survey was brought about by Dr. William Bullock Clark, state geologist. It has been his desire to develop all the economic resources of the state, of which the forest is naturally an im-

Survey and reports on the others examined are in preparation. It is hoped in this way finally to have a complete forest map of the state, together with a knowledge of what sort of forest management is suitable for the many different forest conditions met with. This knowledge should prove very beneficial to private forest owners in the proper management of their wood lands.

Another line of forest work done in Maryland is that of special investigations carried on in the state by the

federal forest service. An excellent study of the growth of chestnut in southern Maryland was made and a report published, which includes many useful tables of growth and volume and practicable recommendations in regard to the management of the species. A similar study has been made of scrub pine, and a report will shortly follow.

To summarize, the forestry movement in Maryland up to the present time has consisted in the gradual education of private forest owners with

time is now ripe for the state to take action and pass laws that will further the cause of forestry and promote one of its most valuable economic resources. The returns from an ill-treated and neglected forest will often be less than a third of those which could be derived from the same forest under proper management, and this is a sufficient economic reason for such state action as will promote the welfare of its forests. There is under preparation a bill, to be placed before the Maryland legislature this winter,



Ridge Timber, Chestnut and Oak, Backbone Mountain, Garrett County, Maryland.

the ideas and principles of forestry through the agencies of the Federal Forest Service and the Maryland Geological Survey, and to some extent inducing these owners to practice forestry wherever it may be shown to be a wise business proposition. As yet there has been no legislative action of importance by the state with reference to its forests. There is one rather inadequate forest law in regard to trespass, and another in regard to fire, the latter applicable to one county. The

providing for adequate forest legislation. The principal points to be included in the bill are: The appointment of a state forester and an outline of his duties; adequate fire laws, and the power of the state to accept and to administer as forest reserves gifts of forest lands. If the bill goes through in the form desired, forestry in Maryland will be put on a much more progressive and permanent basis. The development of private forestry in the state would be greatly facilitated by

proper fire laws; the state forester should help greatly in disseminating the ideas and principles of forestry and in inducing owners to practice forestry wherever it can be shown to be financially profitable. Finally, the power of the state to accept and administer gifts of forest land as reserves would bring about the actual practice of forestry by the state, which should afford a good example in forest management to private owners, as well as eventually being made a source of revenue.

The wood lot is an indispensable adjunct to a well-equipped farm, to furnish the necessary supply of cordwood, fence posts and rails, bean poles and for a hundred and one other purposes, all requiring that there be a woodlot convenient. The farmer's woodlot furnishes one of the best possible opportunities for economic forest management. The farmer has the best chance to bring his woodlot up to the highest possible productive state; the farmer has leisure time during the winter to work in his woodlot and



Hemlock and Hardwoods, near Bevensville, Garrett County, Maryland.

III. POSSIBILITIES OF FOREST MANAGEMENT IN MARYLAND.

It is proposed under this head to consider the practicability of forest management for the three different regions previously designated:

1. *The Piedmont Plateau.* As already stated, this is the most fertile section of Maryland and the forest occurs in small tracts as woodlots connected with farms. Some form of forestry is here almost always advis-

improve it; he can usually find use for inferior and defective trees which should be removed for the benefit of the trees remaining. It will, in short, pay him to make improvement cuttings. The more valuable the land is for agriculture the more intensive should be the forest management in order to realize a reasonable rate of interest on the investment. Where the reproduction and second growth following clear cutting is insufficient, the



White Oak and Hemlock, near Bevansville, in Garrett County, Maryland.



Making a Charcoal Kiln.

natural reproduction should be supplemented by planting or sowing in order that the future stand may be fully stocked and produce a high yield of timber. The farmer will in the end be abundantly repaid if he uses his spare time in the improvement of his woodlot.

Timber brings a good price in this section because of its scarcity, especially such species as chestnut, oak, walnut, and hickory. The growing of chestnut for poles and ties is an especially good proposition, as shown by the bulletin of the United States Forest Service on the subject.

2. *The Appalachian Region.* As previously stated, the outlook for private forest management in this section is not promising, due to the intensive form of lumbering practiced, the prevalence of fires, damaging young growth, and the general slowness of tree growth. No owners of large timber tracts in this part of the state have as yet taken up the idea of conservative treatment of their wood lands. Forest management in this region could best be carried on by the state, rather than by private owners, owing to the long rotation required here to mature timber. There is an increasing amount of cut-over land in this section, non-agricultural and suitable only for growing trees, which will not have a second valuable crop of timber for fifty to seventy-five years, and then only if properly managed. There is no very great inducement for the individual to properly

care for such forest land, with the harvest so far off; while, if managed by the state, the welfare of the next generation would be considered and the forest carefully handled accordingly.

There are some woodlots in this region, adjacent to farms, and for such small tracts private forest management will be advisable. At present, however, not such intensive forestry will be practicable for these woodlots as for those in the Piedmont section, where the land is more valuable and timber much scarcer. But the farmers here should try to keep out fire and improve their wood lots by thinning out worthless and hindering material, so far as it can be done without financial outlay.

3. *The Coastal Plain.* The rapid-growing loblolly and scrub pines in this section, which attain merchantable size in thirty to sixty years, are good propositions for private forest management, especially the loblolly. Most of the land on which this pine occurs is of little value for agriculture, and will often bring better returns from growing timber on short rotations than from crops. In thirty years the scrub pine is valuable for pulpwood or charcoal. The loblolly it is best to cut for lumber as it is sufficiently large in thirty-five to forty-five years.

The outlook for forestry on wood lots in this section is nearly as good as for the Piedmont Region, though timber prices are not as a rule so high.

RECENT PUBLICATIONS

Forestry and Forest Products of Japan.

Bulletin of Bureau of Forestry, Department of Agriculture and Commerce, Tokyo, Japan. Published for distribution at the Universal Exposition, St. Louis, 1904. Pp. 118, with diagrams. Tokyo, 1904.

The forest administration of the Japanese Empire is regulated by the Forest Law of 1897, providing rules regarding the working of the "Available Forests," as well as the

restriction of felling in the "Reserve Forests." At the present date the reserve forests of the Empire include 699,148 *cho*, or some 269 square miles, and the government has a well-defined forest policy, whose range of activity is remarkable. In results accomplished, explained in this book in a very interesting manner, the Japanese forest service will rank high with that of other nations. This volume is full of informa-

that is interesting to the American forester and forest student, and contains some very valuable increment tables of Japanese trees, descriptions of the various types of forest, and of some of the more important tree-species, together with an interesting exposition of the workings of the government forest service.

Report of the Pennsylvania Department of Forestry for the Years 1903 and 1904. Pp. 106, illustrated. State Printer, Harrisburg, 1904.

Mr. Robert S. Conklin, Commissioner of Forestry, state that his department is conducting a "work which is constantly on the increase, and coming to be most important, affecting as it does the well-being of our citizens and the whole industrial life of the Commonwealth. The report here presented includes a report of Dr. J. T. Rothrock, Commissioner of Forestry during 1903, and until May 31, 1904, and of his successor, Mr. Conklin, from June 1, to December, 1904. There are also included the report of the State Forester, Mr. George H. Wirt; a report of the Camp Sanatorium for poor convalescents, at Mont Alto, by Dr. Addison Rothrock; a report on the State Forestry Academy at Mont Alto; a paper detailing "Rational Method for the Cultivation of the Willow," by Mr. Paul E. Arnold; a History of Forest Fire Legislation in Pennsylvania, as a Province and State," by Edwin C. Williams, Esq., Deputy Commissioner of Forestry; and a statement of the amount of timber cut and the losses by forest fires during two years, tabulated from data collected by the department.

Annual Report of the Smithsonian Institution for 1904. Pp. 804, illustrated. Government Printing Office, Washington, 1905.

Included in this report are two articles which should be of unusual interest to readers of this magazine, "The Work of the Reclamation Service," by F. H. Newell, Chief of the U. S. Reclamation Service, and "The Yuma Reclamation Project," by Mr. B. B. Lippincott, Supervising Engineer, U. S. Reclamation Service. The volume contains, as usual, a mass of scientific data and information that is as interesting as it is valuable.

Report of the Secretary of the Interior for the Fiscal Year Ending June 30, 1905. Pp. 286. Government Printing Office, Washington, 1905.

The administration of the public lands of the United States, the construction of government irrigation works under the Reclamation Act, the administration of the

national parks and reservations, the mapping and surveying of the United States, are a few of the branches of activity which are centered in the Department of the Interior, and in which readers of *FORESTRY AND IRRIGATION* should be interested. In the volume presented here is included also a report on the workings of the General Land Office in the administration of forest reserves prior to July 1, 1905, when that work was transferred to the U. S. Forest Service.

In the fields of both irrigation and forestry the report shows a gratifying amount of work done in furtherance of these two all-important subjects.

Report of the Secretary of Agriculture, 1905. Pp. 132. Government Printing Office, Washington, 1905.

Of particular interest in this report is the summary of work accomplished during the fiscal year of 1905 by the divisions of the Agricultural Department having in charge the forest work and the irrigation investigations of the government. Referring to the first, the Report states: "The work of the Forest Service has been greatly developed. Of the eleven persons employed July 1, 1898, only two were professional foresters. To-day the Forest Service employs 153 professional foresters out of a total force of over 800 persons. An important achievement of this Service during the past few years has been to enlist the sympathy and co-operation of lumbermen and forest owners, and the Secretary urges that the work of education continue until public opinion will not tolerate heedless waste or injudicious loss. The forest reserve property of the government is administered at a cost of less than one-third of 1 per cent of its value, which increases at the rate of 10 per cent per annum."

Of the Division of Irrigation and Drainage, the Secretary reports:

"The irrigation and drainage investigations of the Department have resulted in the systematic study of the agricultural and legal features of irrigation. Measurements of the quantity of water used in ordinary practice have been followed by more careful experiments to determine the frequency of irrigation and the amount of water to be applied to get the best results. The studies of irrigation laws have included the collection of facts showing the character and amount of water rights. Experiments are being made to determine how far drainage can be made to protect hillsides from destructive effects of erosion." The report is replete with valuable information and statistical data regarding the government work carried on by the Department of Agriculture.



PUBLISHERS' NOTES

Of special interest to the tree planter and forester is the price list of seeds of trees, shrubs, etc., issued recently by Thomas Meehan and Sons (Inc.), of Dreshertown, Montgomery county, Pa. This firm was probably the first in the United States to realize the need for forest planting of seeds of the better-known species of forest trees, and through a long period of business activity their customers have learned to appreciate the unusual efforts the firm exerts to secure sound seed of the best stock. Precautions are taken to positively identify all trees from which seeds are secured, and the customer is assured of receiving the species ordered—not that of some inferior variety. Their "Tree Catalogue" gives detailed information of the firm's stock and their facilities, and any of our readers having occasion to do planting, whether in landscape gardening, or in forestry, will find it of interest and value.

Our readers will notice an advertisement of the Hart Pioneer Nurseries, of Fort Scott, Kansas, running in this paper, regarding an improved Veneered "Tree Protector."

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2. Fish Culture.
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4. Aquatic Plant Life.
5. Casts and Drawings.
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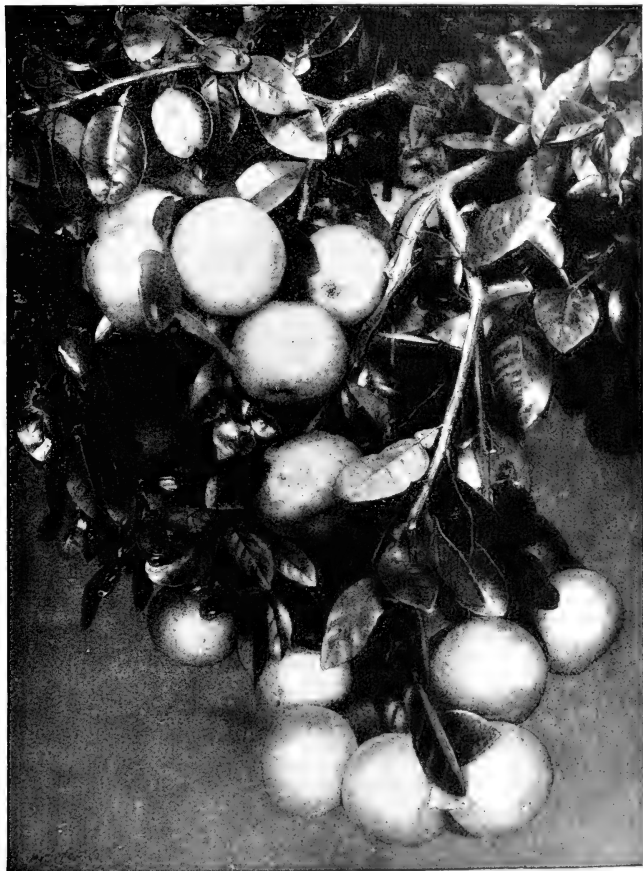
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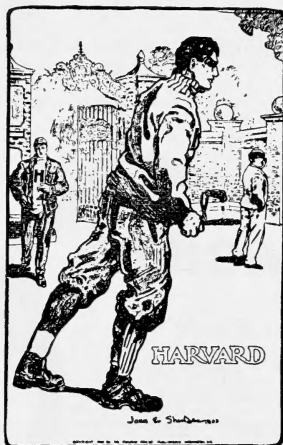
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The objects of the Association, as set forth in its Constitution, are as follows:

1. The adoption by the Federal Government of a permanent policy for the reclamation and settlement of the public domain, under which all the remaining public lands shall be held and administered as a trust for the benefit of the whole people of the United States, and no grants of the title to any of the public lands shall ever hereafter be made to any but actual settlers and homebuilders on the land.

2. The preservation and development of our national resources by the construction of storage reservoirs by the Federal Government for flood protection, and to save for use in aid of navigation and irrigation the flood waters which now run to waste and cause overflow and destruction.

3. The construction by the Federal Government of storage reservoirs and irrigation works wherever necessary to furnish water for the reclamation and settlement of the arid public lands.

4. The preservation of the forests and reforestation of denuded forest areas as sources of water supply, the conservation of existing supplies by approved methods of irrigation and distribution, and the increase of the water resources of the arid region by the investigation and development of underground supplies.

5. The adoption of a harmonious system of irrigation laws in all the arid and semi-arid states and territories under which the right to the use of water for irrigation shall vest in the user and become appurtenant to the land irrigated, and beneficial use be the basis and the measure and limit of the right.

6. The holding of an annual Irrigation Congress, and the dissemination by public meetings and through the press of information regarding irrigation, and the reclamation and settlement of the arid public domain, and the possibilities of better agriculture through irrigation and intensive farming, and the need for agricultural education and training, and the creation of rural homes as national safeguards, and the encouragement of rural settlement as a remedy for the social and political evils threatened by the congestion of population in large cities.

